Gas Journal

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Editorial Notes

The Coal Bill

THE Second Reading of the Coal Mines Bill was opened on Monday, Nov. 22, by Mr. Oliver Stanley, the President of the Board of Trade. Mr. Stanley said that it was not claimed that the Coal Mines Act, 1930, was " either a particularly good bit of legislation or that it had worked particularly well." He claimed, however, that the selling organizations set up in 1935 had averted a serious crisis by putting the industry on a better basis, and that the amended schemes of that year had enabled the industry to receive bigger prices out of which it had been possible to meet some part, at any rate, of the demands of the miners for increased wages. He thought that it would be a breach of faith to let the schemes lapse, because it was the promise of the improvement which they would bring to the industry which was responsible for averting what would have been a disastrous stoppage in 1935.

Mr. Stanley pointed out that the coal industry took a sudden and marked turn very shortly after the amendment of the schemes. " A marked improvement in the demand for coal set in, and what had been a period of great glut became very quickly a period almost of scarcity. That was naturally accompanied, as any such change must be, by a rise in the price of the commodity, a rise in the price of coal, and as this rise coincided to some extent with the introduction of these schemes, these schemes have in some quarters been blamed for the increase." This, he thought, was quite unjustified. The Government were anxious to see that nothing within the main purpose of these schemes should be done to prejudice the consumer and realized that the chief safeguard of the consumer lies in the Committees of Investigation. The President of the Board of Trade then described the proposed alterations with regard to the composition and procedure of the Committees, with which readers of the " JOURNAL " are already familiar.

The debate does not indicate that many Members considered that the interest of the consumers was a matter of major importance; and the concessions made by the Government in connection with the Committees of Investigation appear effectively to have blinded the majority of the House to the main essence of our dissatisfaction. Mr. L. Ross Taylor was therefore well justified in opening his excellent speech with the remark that " we hear a great deal about the interest of colliery owners and the mine workers, but comparatively little of the interests of the coal consumers." The Industry will endorse Mr. Ross Taylor's disagreement with that statement of the President of the Board of Trade that the monopolistic selling schemes had not been the principal cause of the rise in prices. Mr. Ross Taylor emphasized that the Committees of Investigation had no power, either at present or under the Bill, to give effect to any recommendation that coal prices should be lowered, and without such power " there is no doubt that the safeguarding machinery must remain ineffectual. The Gas Industry will also note with appreciation the speech of Sir Reginald Clarry, who made telling reference to the great disparity between retail prices and pithead prices. Sir Reginald also cited the case of a gas undertaking in South Wales from which 23s. a ton has been demanded for next year's supply as against last year's price of 12s. 6d. Sir Reginald suggested that Committees of Investigation were well named, since they had powers to do very little more than investigate—" a mere smoke screen behind which the scheme can operate and manipulate prices to its own requirements."

It cannot be denied that the answer of the Secretary of the Mines Department to these charges is extremely unsatisfactory. He contended that Committees of Investigation were singularly unsuitable bodies to fix prices, and emphasized that the Government stood by the continuation for another period of the Act of 1930, " which is the statutory basis for the selling schemes in the industry to-day." It may be satisfactory to the Government that a majority of 162 was obtained on Second Reading, but there is little doubt that the real fight will come on Committee stage. Sooner or later the Government will have to face the vital question of the adequate protection of the consumer from the monopolistic powers of the selling organizations. In the meanwhile it is to be hoped that all gas undertakings in the country will take steps to impress upon their Members of Parliament that they regard the present situation as most gravely unsatisfactory.

Combustion Characteristics

THE research work undertaken during the past twelve months on the problem conveniently expressed as the "combustion characteristics" of gas has shed much light on what is without doubt an exceedingly complex subject. It is most desirable now that all forces should be concentrated on the elucidation of the problem, which has such an important bearing on the future use of gas in the home and in industry. This was made manifest at the Autumn Research Meeting of The Institution of Gas Engineers when the Joint Research Committee of the Institution and Leeds University presented their 40th Report. It is clear that what are known as the combustion characteristics of a gas should be made subject to measurement and numerical expression in such a form that the behaviour of the gas in a domestic or industrial appliance can be forecast with confidence when these measurements have been made. The Report is a most valuable and helpful critical review of the existing literature upon combustion characteristics; it will prove of great service to all those having to deal with gas utilization and the problems of combustion of gases.

It is abundantly clear that if the best results are to be obtained from modern gas appliances constancy of calorific value alone is not sufficient; the rate and manner of combustion of a gas are only second in importance to the actual amount of heat developed. Wide variations in bunsen flame sizes can be produced with gases covering a similar range of calorific value, and throughout the country the gas consumer is probably getting a result which falls far short of that which a domestic gas supply is capable of yielding. In the future, gas composition may change considerably compared with the present day. Consumers demand an ever-increasing standard of heat service, and it would be intolerable, as Mr. Masterman insistently maintains, if progress in other directions led to an increase in the number of noisy burners, appliances lighting-back, and the like. The object of the work now being undertaken by the Joint Committee and in other quarters, notably at the Watson House Laboratories of the Gas Light and Coke Company, is to anticipate such troubles and point the way to avoiding them. It is of vital importance that the fullest knowledge be made available to the designers of gas appliances and those responsible for manufacturing and distributing gas. We have been without a method of measuring these combustion characteristics in any quantitative way. Some may consider that the subject is not of sufficient moment to warrant the work and expense entailed. Experience of district difficulties, however, where combustion quality variations are prevalent can only lead to the conviction that satisfactory service in this direction is one of the points on which our Industry will stand or fall.

Undoubtedly the work requires, as Mr. Masterman says, the co-operation of the whole Gas Industry. Whereas at Leeds the fundamentals of the problem are being attacked, the Industry has now available, in the aeration test burner developed at Watson House, an instrument, not of scientific precision, but capable of acting as a rough criterion of the satisfaction or dissatisfaction of the consumer. None of the test burners in this or other countries provides a fundamental measure of combustion characteristics, but of all the available instruments the "A.T.B." seems the most suitable for giving indications of practical value. This is the conclusion of the Joint Research Committee following a painstaking examination of the various types, and it is to be hoped that both gas undertakings and appliance makers will decide to collate data by the use of the "A.T.B." instrument. This would at any rate lead to a rough check on the one hand of the range over which various existing appliances will operate satisfactorily, and on the other hand of the type of changes which should be anticipated in gas composition on the district and their effect on appliances in terms of consumer service. The Report of the Joint Research Committee is, of course, for the most part concerned with the burning of gas in bunsen burners, but there is also need for data on the behaviour of town gas burnt without pre-admixture with air. There is an immense field for study.

A Check on Performance

WE would call particular attention to the written contribution by Mr. L. T. Minchin, of the Gas Light and Coke Company, to the discussion on the 40th Report of the Joint Research Committee published in last week's "JOURNAL," for it indicates the promise held out by the development work on the aeration test burner. Mr. Minchin points out that a change in gas composition may affect the performance of a gas appliance in two ways; it may alter the B.Th.U. input by changes in calorific value or specific gravity, or it may alter the character of the flame, in particular the height of the inner cone. It is the change in cone height which is most likely to affect performance adversely on any given area of supply. The A.T.B. Number may be regarded as a reliable indication of gas characteristics in so far as they affect the size of the inner bunsen flame. A marked change in the A.T.B. Number, whether or not accompanied by other changes, will probably cause gas appliances to function less satisfactorily; and Mr. Minchin summarizes the principal defects likely to arise from changes in gas quality as denoted by the aeration test burner. His figures relate to a gas having a calorific value of 500 B.Th.U. He shows that virtual immunity from trouble could be obtained by so ordering affairs that no appliance could be subjected to a change of more than ten divisions on the A.T.B. scale. This could be brought about in two ways. If it is customary for all appliances to be adjusted by the fitter on the job, then the overall variation would have to be kept to ten divisions, since it would be impossible to say at what part of the range the appliance had been initially adjusted. If non-adjustable burners are employed, however, a variation of at least ± 10 would be permissible, provided that all appliances were designed to work on an agreed mean figure about which the variation in the gas quality took place.

This provides an additional argument for the desirability of fixed injectors, the employment of which we have so long advocated. Their use would render tolerable a wider variation in the methods of gas manufacture. It is probable, as Mr. Minchin observes, that many undertakings do not conform to the suggested limits, and they may be expected to experience a considerable amount of trouble in consequence without it being recognized as being due to this cause. If a gas fire, for example, were to fail to light up properly soon after it had been installed, the tendency would be for blame to fall on the fitter who had adjusted it, and, conversely, the fitter, in order to avoid repetition of the experience, would probably learn to set similar fires to a rather softer flame than official instructions recommend. Possibly a more serious case would arise in the event of an increase in A.T.B. Number after the appliance had been adjusted. In this case no actual complaint might be made to the gas undertaking although the appliance was no longer giving satisfactory products of combustion. In

these circumstances the user would be apt to gain quite a wrong impression of the gas service, naturally being unaware that the appliances needed re-adjusting to compensate for the change in gas quality. The point is that variations in the A.T.B. Number of town gas, unless kept within suitable limits, have the general effect of depreciating the value of the service which the Gas Industry can give its consumers.

Gasholder Purging

That increased attention must be given to ensuring that all gasholders are maintained in safe condition and are working satisfactorily is apparent; and lately we have had a wealth of useful information on the subject. In many cases in the past the maintenance has not been all that it should have been, and in some instances examination will show that, in spite of smooth operation, repairs are necessary to ensure safe working. The requirements of the new Factories Act, which comes into operation in January, include the inspection of gasholders, but these requirements ought not to press unduly on any undertaking. The regular examination of holders and the keeping of records required by the Act have been urged for years by the Gasholder Committee of The Institution of Gas Engineers—now merged in the Gas-Works Safety Rules Committee—and the record sheets which the Committee has prepared will be of great assistance. It should, of course, be emphasized that the responsibility of gas undertakings is in no way lessened by the new Act; it is necessary for all undertakings to maintain the daily routine without failure. In regard to the inspection and maintenance of holders, Mr. G. M. Gill, in a Paper to the Midland Association published in to-day's "Journal," explained what a holding company can do for the smaller member undertakings. In the group of gas companies to which he refers it has been found advisable to engage a skilled gasholder foreman erector with a life-long experience to attend exclusively to holders and to carry out repairs and deal with all difficulties which may arise in their working; and at the Research Meeting of the Institution Colonel Carr mentioned that in the group of undertakings with which he is connected there is full-time work for an inspector in examining and attending to holders.

It is evident that this stringent but necessary inspection will disclose the need for considerable repair work of an important nature, and in this regard the information on the purging of gasholders which has been forthcoming during the past few weeks is most opportune. At the Institution Research Meeting Mr. F. M. Birks, of the Gas Light and Coke Company, described a simple method of purging with inert gas by which we can be 100% safe in either clearing a holder or recharging it with gas. The Gasholder Committee, it will be noted, in its Report did not formulate recommendations as to purging; but, in his introduction to the Report, Mr. Thomas Hardie referred to holders which are badly situated—there may be property adjoining, in which case it is difficult to control what takes place. In such circumstances, said Mr. Hardie, the Committee certainly recommend that the use of the method described by Mr. Birks should be carefully considered. A similar method was the subject of a Paper by Mr. F. J. Bengough, of the Birmingham Gas Department, published in the "Journal" for Nov. 17; and it may be mentioned in passing that 4½ years ago the Department appointed a gasholder examiner and provided him with an adequate staff for the maintenance and supervision of holders.

Inert Gas Safety Method

We certainly are of opinion that the method under review merits the closest consideration, for during the operation of purging a gasholder by air the holder is at certain times a potential danger of such magnitude that any amount of trouble is worth taking to eliminate the possibility of accident. After due consideration of the safe method now available, no one can ignore such a means of carrying out a task necessarily accompanied by risk. As to the cost of the procedure, the cost of inert gas is about 8d. per 1,000 cu.ft., with town gas at 2s. per 1,000 cu.ft., dependent to some extent upon the cost of water. The operating costs amount to between £2 and £10 per holder, dependent on its size. As an example, Mr. Birks gave the increase in cost of purging a holder by inert gas instead of by the usual means as £50. With a medium or large size holder this sum represents a small proportion of the whole cost of carrying out an internal inspection and repair. Moreover, the machine can be used for purposes other than the purging of holders. For instance, operations involving welding can be extended to fields where hitherto it would have been dangerous to introduce a flame; and the machine can be used for displacing gas from any sections of plant and from lengths of main. "Purging," said Mr. E. G. Stewart, during the discussion on Mr. Birks' Paper, "opens up a new era to the gas engineer. . . . The cost is small when peace of mind alone is considered; from the point of view of an insurance premium it is absurdly low." The smaller undertaking may feel apprehensive of the cost of the machine in view of the fact that its use may be called upon infrequently. For this reason it is gratifying that steps are being taken, as explained by Mr. D. M. Henshaw at the Institution Meeting, to develop a machine which can be hired. Inauguration of such a service would, we are sure, be greatly welcomed. It is, of course, essential that an inert gas purging machine should be properly designed and correctly used, otherwise there is the possibility of users being lulled into a false sense of security. The control of the quality of the purge gas is, however, fairly simple, and estimating the proportion of inert gas in the mixture by means of the carbon dioxide content is quite a reliable method. For the smaller undertakings the hire service might perhaps include skilled operation of the plant. Undoubtedly the method represents an important advance in gas-works technique and its wide-spread adoption would appear desirable.

1937 "JOURNAL" DIRECTORY

Page 20. DERBY. Sir John Ferguson Bell, Ch. & M.D., deceased.

Page 40. LIVERPOOL. E. Astbury appointed C.E., vice R. E. Gibson, deceased.

Page 44. MACHYNLLETH. J. W. Lane, E. & M., retired.

Page 46. MILLOM. L. Brush appointed E. & M., vice T. H. Rich, retired.

Page 68 TORQUAY. R. C. Taylor, D., E., & G.M.

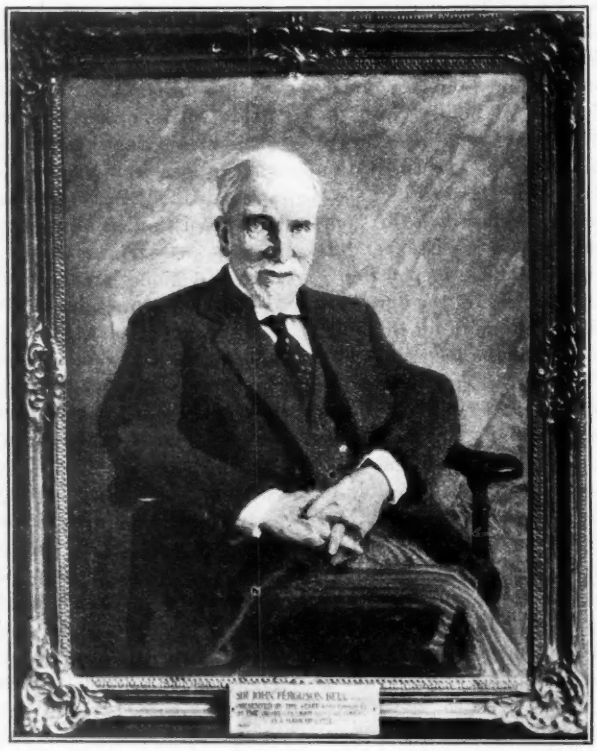
Page 74. WIGTON. S. Blair appointed S., vice J. Strong, resigned.

OBITUARY

SIR JOHN FERGUSON BELL.

As was briefly announced in our last week's issue, the death took place on Nov. 21 at Ivy House, Mickleover, Derby, of Sir John Ferguson Bell, J.P., Chairman of the Derby Gas Light and Coke Company, at the age of eighty-one. The sympathy of the whole Gas Industry will be extended to Lady Ferguson Bell and her two daughters, Miss E. Bell and Mrs. McLachlan, in their sad loss.

Sir John's career, both in the Industry and in many spheres of public life and service, was marked by an unswerving devotion to duty and crowned with conspicuous success. It began, professionally, at Birkenhead, where he served a pupilage under his uncle, the late W. T. Callow, who was for many years Chief Gas and Water Engineer in that town. Studying at Liverpool University and passing through various positions at Birkenhead, he was appointed Assistant Engineer before going to Stafford, where he became Engineer and Manager to the Stafford Gas Department. While he was at Stafford, the Works were almost entirely rebuilt and enlarged; and later in conjunction with the late Dr. John Hopkinson, F.R.S., he erected the electricity works at Stafford, subsequently taking over their management in addition to that of the Gas Undertaking.



His long association with the Derby Gas Light and Coke Company began in 1900 when, on the retirement of the late Charles Taylor, he was appointed Chief Engineer and Manager of the Undertaking. In that capacity he carried out large extensions at the Litchurch, Cavendish Street, and Belper Works of the Company. While carrying out his professional work on behalf of the Company with characteristic energy, Sir John yet found time to participate actively in the public life of the City. Thirteen years' invaluable service to the Council culminated in his unanimous election in 1928 as Mayor of the City; in 1930, on the death of his successor to the Mayoralty, he was re-elected to serve for the remainder of the period.

In 1925 he was appointed a Justice of the Peace for Derby.

His many and varied interests included his association with the Derwent Valley Water Board, the Trent Catchment Board, and the Derby Savings Bank, and his membership of the management board of the Derby Deaf and Dumb Institution. Sir John's public services were duly recognized in 1931, when, to the delight of his many friends, he received the honour of Knighthood.

His career in the Gas Industry, which embraced the responsibilities attending the holding of directorships on the boards of a number of gas undertakings and an extensive consulting practice, was marked with conspicuous success, and the approbation of his colleagues and many friends in the Industry was endorsed in 1925 when he was elected President of The Institution of Gas Engineers. Those who had followed Sir John's career closely, however, knew that the honour might have come much earlier had it not been for his gracious act whereby, in 1913, he stood aside that Sir Corbet Woodall might, as was fitting, act as President during the Jubilee Year of the Institution. The following year he was again offered the Presidency, but found himself unable to accept on that occasion owing to reasons of health. There was another reason for his declining the honour—a reason which sheds an interesting sidelight on his character. This is best expressed in Sir John's own words from the Presidential Chair during the 1925 Meeting of the Institution, "I certainly had not the experience that I have since acquired." A modest statement from one who had been a prominent member of the Institution since 1884 and who had been awarded the Silver Medal in 1904 for his Paper on de Brouwer stoking machines.

In 1929 he was elected to the Board of the Derby Company, while retaining his position as Engineer and Manager, in recognition of his long and valued service. In 1931 he became Deputy-Chairman, being elected Chairman the following year. On his retirement in March, 1932, from the position of General Manager of the Company after thirty-two years' service in that capacity, he was presented by the officers, staff, and workpeople with his portrait in oils—the work of a local artist—of which we here reproduce a photograph. At the ceremony reference was made to the wonderful strides on both manufacturing and distribution sides that had been made by the Undertaking under Sir John's management. The output of gas had increased threefold; the number of consumers had been more than doubled; and the mileage of mains had increased from 90 to 300, while five other gas undertakings had been absorbed.

Sir John was a member of both the Institution of Civil Engineers and the Institution of Mechanical Engineers.

AN APPRECIATION

BY

WALTER T. DUNN.

The death of Sir John Ferguson Bell at the age of eighty-one has claimed a personality with whom in my work as Secretary of The Institution of Gas Engineers I became closely acquainted. His sound judgment, kindly disposition, and willingness at all times to be of service in whatever way possible, were his outstanding characteristics. On the various occasions he represented the Institution in this country or abroad he always acted with dignity and a sense of his responsibility as the elected head of the British Gas Industry.

An outstanding instance of his generosity which will be remembered by many occurred in 1913, when, in order that Sir Corbet Woodall might be President during the jubilee year of the Institution, Sir John at once relinquished his right of succession. His year of office was thus deferred to 1925, when the annual meeting was marked by the presentation of the Birmingham Medal to Dr. Charles Carpenter and the election as Honorary Members of the late Charles Hunt and Sir Frederick J. West. Sir John's meeting was also signalized by a memorable visit to Derby for an inspection of the Works of his Company. The journey was made by special train arranged by his friend, Sir Henry Fowler, then Chief Mechanical Engineer to the L.M.S. Railway Company, and incidentally a former member of the Institution when Gas Engineer to the old Midland Railway Company at Derby.

To Lady Bell and her two daughters the sympathy of their many friends in the Institution will be respectfully offered.

From R. S. RAMSDEN.

Having had the good fortune to be fairly closely associated with the late Sir John Ferguson Bell for well over thirty years may I be allowed to bear witness to the helping hand and friendliness which he always extended to me and, I believe, to a number of men, particularly those about thirty years his junior?

He had a fairly extensive practice as a consultant, and remarked to me once that whenever he was called in by a Gas Committee or Board he always tried to help the man in charge—and I think he generally succeeded in doing so.

He was a man who needed to be known to be appreciated, and beneath a sometimes brusque manner there was a wonderful friendliness and sympathy. I know that many people have been helped by him anonymously. The Gas Industry and the country have lost one who has served them well.

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Formerly Engineering Surveyor to Hartlepool Gas and Water Company for many years, Mr. S. F. SAINTY has died at his home at West Hartlepool. He was seventy-nine. Mr. Sainty retired only two years ago after 44 years' service with the Company.

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We much regret to report the death last Thursday of Mr. ALBERT W. GLOVER, a Director of the firm of Messrs. George Glover & Co., Ltd., Gas Meter Manufacturers, Chelsea. He was aged 67.

Mr. Glover joined the firm in 1887, eventually succeeding his father, Mr. J. William Glover, as Director and General Manager. He retired from active management in 1931, but as a Director he still maintained his close association with the Company. Mr. Glover was well known to the members of the whole meter industry, among whom he had many friends. His loss will be most keenly felt.

A man of kindly impulses, unfailing courtesy, and strict integrity, it can truly be said that he earned the affection as well as the respect of all those who worked with him.

Personal

Ex-Provost LISTER was on Nov. 22 appointed Chairman of Buckhaven and Leven Gas Board.

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We learn from Mr. FRANK P. TARRATT, M.Inst.C.E., that he proposes to retire early next year from his position as Chief Engineer to the Newcastle-upon-Tyne and Gateshead Gas Company. Mr. Tarratt has held the position for 17 years, having succeeded Mr. Thomas Hardie on his appointment as Chief Engineer to the Gas Light and Coke Company.

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Alderman H. CARVER, who for the past year has been Vice-Chairman of the Gas Committee of Leicester City Council, and who for a number of years previously was Chairman of the Committee, has now retired at the age of 78.

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On Nov. 19 a presentation of a chiming clock was made to Mr. GEORGE FULLER on the occasion of his retirement from the service of the King's Lynn Gas Company, of which he was Chief Clerk. The presentation was made by Mr. G. B. L. Wilson, Engineer and Manager, who spoke with appreciation of Mr. Fuller's 33 years' service with the Company, and wished him a speedy recovery from the illness which had occasioned his comparatively early, and much regretted, retirement. Mr. Fuller expressed his thanks in a short speech.

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After a grave illness extending over six months, Mr. HORACE LONG, Secretary and Accountant of the East Surrey Gas Company, has recently returned to duty. We are pleased to have his assurance that he is now well on the road to complete recovery.

An Electrician on Gas Salesmanship

"They Mean Business"

Comment on the greater interest taken by the Gas Industry in salesmanship was made by Mr. J. Harcourt Williams, Deputy Chief Engineer of the Manchester Corporation Electricity Department, at the annual dinner of the local branch of the Electrical Contractors' Association, held at the Midland Hotel, Manchester, on Nov. 23.

"Our sister industry," he said, "is showing much more interest in the sales side than it has done in the past. You have only to see their new showrooms in the Manchester Town Hall extension to appreciate that they mean business." Whether Mr. Williams intended this as a compliment to our Industry is not clear, but having regard to the emphasis which he placed on the desirability of co-operation between all who are concerned in the supply of domestic electrical fittings, it is obvious that he implied there were directions in which electrical traders might benefit from the precepts of the Gas Industry.

Forthcoming Engagements

Dec.

2.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.

2.—MIDLAND JUNIORS.—Meeting and Paper by F. A. C. Pykett on "Re-selling the Cooker Load by Vitreous Enamelling."

3.—I.G.E.—Research Executive Committee, 10.30 a.m.; Advisory Committee on Research, 2.30 p.m.

4.—MANCHESTER AND DISTRICT JUNIORS.—Visit to Manchester Oxide Company, Ltd. Papers by R. H. Clayton and H. B. Avery.

6.—LONDON AND COUNTIES COKE ASSOCIATION.—Technical Committee, 11.30 a.m., Gas Industry House.

9.—I.G.E.—Gas-Works Safety Rules Committee, Gas Industry House, 2.30 p.m.

9.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at Gas Industry House, 2.30 p.m. Discussion "Re-Organization of Maintenance Service at Brighton."

11.—WESTERN JUNIORS.—Visit to Trowbridge Gas-Works. Paper by V. J. Borrett on "Works Extensions at Trowbridge."

11.—SCOTTISH JUNIORS.—Joint Meeting at Glasgow. Address by G. Dixon (Junior Vice-President of the I.G.E.).

11.—YORKSHIRE JUNIORS.—Visit to Hopkinsons, Ltd., Huddersfield.

13.—I.G.E.—General Purposes Committee, 11 a.m.; Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.

14.—I.G.E.—Council, 10 a.m.; Gas Education Executive Committee, 2.30 p.m.

14.—LONDON AND SOUTHERN JUNIORS.—Meeting and Paper by A. T. Green on "Features Concerning the Use of Refractory Materials in Gas-Works."

14.—N.G.C.—Meeting of the Central Executive Board, Gas Industry House, 2.30 p.m.

16.—S.B.G.I.—Council Meeting, 2.30 p.m.

16.—I.G.E.—Refractory Materials Joint Committee 2.30 p.m.

20.—LONDON AND COUNTIES COKE ASSOCIATION.—Finance Committee, 10.45 a.m.; Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m., Gas Industry House.

1938.
Jan.

1.—LONDON AND SOUTHERN JUNIORS.—Visit to the Headquarters of the London Fire Brigade.

7.—I.G.E.—Joint Committee on Complete Gasification under Pressure, 3 p.m., at 16, Old Queen Street, S.W. 1.

8.—SCOTTISH EASTERN JUNIORS.—Visit to Milne's Meters, Ltd., Edinburgh.

13.—MIDLAND JUNIORS.—Meeting and Paper by A. T. Green.

15.—SCOTTISH WESTERN JUNIORS.—Debate meeting.

15.—YORKSHIRE JUNIORS.—Meeting at Leeds. Paper by W. S. Hubbard, "Choice of Gas Storage."

18.—LONDON AND SOUTHERN JUNIORS.—Meeting and Paper by R. T. d'Eyncourt, "Load Value of Appliances as a Guide to Sales Policy."

"Weeds, Weeds, Weeds"

A Book by Sir Charles Boys

In a small book written in a most charming style Sir Charles V. Boys, so well known to the Gas Industry, recounts his experiences over a matter of seventy years in battling against weeds in his garden, and he sets out in very readable manner a series of remedies which are the result of these experiences. "The battle with weeds," he remarks, "so often is a drawn battle in which a sort of equilibrium is the utmost that can be hoped for." The advice he has to offer, however, will present the reader of this fascinating little book with new weapons of attack which will render the struggle all the easier. Hundreds of thousands of gardeners, on the large scale or those with only tiny plots, cannot fail to derive both enjoyment and benefit from the book, which Sir Charles himself describes as a "weed contest autobiography." At the modest sum of 1s. "Weeds, Weeds, Weeds" is extraordinarily good value. The publishers of the book, which is packed with sound advice, are Wightman & Co., Ltd., Regency Street, S.W. 1.

News in Brief

For Mains Extensions, the Blackburn Corporation are seeking permission to borrow £5,000.

A Generous Contribution of £50 has been made by the employees of Messrs. R. & A. Main, Ltd., Falkirk, towards the Falkirk and District Royal Infirmary Nurses' Home Appeal.

Representatives of Glasgow Corporation and Messrs. William Dixon, Ltd., Govan Iron Works, Polmadie, Glasgow, are to meet on Dec. 16 to discuss the offer made to the City of a supply of cheap coke oven gas from the Company's modernized furnace plant.

A Lecture was given by Mr. T. V. B. Hirst, of Ascot Gas Water Heaters, Ltd., to the employees of the Cambridge University and Town Gas Light Company on Nov. 24. The Engineer and Manager, Mr. J. Hunter Rioch, who was in the chair, introduced the speaker.

An Extension of the existing limits within which Hull Station of the British Gas Light Company are authorized to supply gas is among the objects of a Special Order for which the Company intends to apply to the Board of Trade under the Gas Undertakings Acts, 1920 to 1934.

Among the Provisions of a Special Order for which the Stockton-on-Tees Gas Department intend to apply to the Board of Trade, under the Gas Undertakings Acts, 1920 to 1934, is one which seeks authorization to extend the limits of supply to include certain adjoining parishes and townships.

The Half-Yearly Figures of gas sold by the Lincoln Gas Department for the six months ended Sept. 30, 1937, compared with the same period for 1936, shows the following results: Increase in industrial consumption, 44 million cu.ft.; in public lighting, 2½%; in prepayment meters, 6%; and in quarterly meters, 2½%—making a total increase of 19%.

Applications are Invited by the Bury Gas Department for the position of Draughtsman and Technical Assistant in the distribution department. The commencing salary will be £200 per annum, rising—subject to satisfactory service—by annual increments of £10 to a maximum of £250. Further particulars will be found in our advertisement columns this week.

Alterations to the Gas-Works have been under consideration by the Dunbar Gas Commissioners for some time, and it has now been decided to erect a new instrument room as well as an office for the Gas Manager. Specifications are also being obtained for the installation of auxiliary plant which, it is expected, will be proceeded with in the near future.

Members of The Institution of Gas Engineers will be welcomed at the Public Lecture to be given on Friday, Dec. 17, 1937, by Dr. R. E. Slade, F.I.C., on "The Development of Grass Drying" at 6.30 p.m. at the Institution of Civil Engineers, Great George Street, London, S.W. 1. Tickets can be obtained from the Institution of Chemical Engineers, 56, Victoria Street, S.W. 1.

An Official Trade Sign has, with the consent of the Board of Trade, been adopted by the Institute of Vitreous Enamellers. Approved vitreous enamellers will, therefore, be permitted to brand their ware with this sign in the form of labels, tags, or transfers, and as part of the campaign to educate the consumer to appreciate the importance of insisting that all his purchases of enamelled ware should bear this official sign, a brochure has been prepared by the Institute. It is of the utmost importance to the future usefulness of the Institute to ensure that the maximum use is made of this sign.

Prices of Gas Appliances

We understand that the stove manufacturers do not contemplate making any further advances, and present prices will remain unless there is some substantial change in the market conditions.

CURRENT EVENTS IN THE GAS INDUSTRY

Amalgamation and Grouping

Stellite Offer to Bethesda.

The Bethesda Urban Council has had under consideration a letter from the Stellite Company offering to buy the gas undertaking and stating that they would sell the gas to consumers for 5s. 5d. per 1,000 cu.ft. The present rate is 6s. 5d. Councillor W. E. Williams proposed that the letter be left on the table, an amendment by Councillor M. R. Evans that the Manager of the Stellite Company be invited to Bethesda to explain his proposal to the Council being defeated.

Scottish Eastern Juniors

Short Paper Day at Edinburgh

About 35 members of the Scottish Junior Gas Association (Eastern District) met in the Heriot-Watt College, Edinburgh, on Saturday, Nov. 6.

Mr. J. M. Dow, Kirkcaldy (immediate Past-President) took the Chair, and introduced Mr. A. C. Rea (Perth) as incoming President. Paying tribute to Mr. Rea, he mentioned his success as a student which had been officially recognized by his recent appointment as Engineer and Manager of the Perth Corporation Gas Department.

Mr. Rea, taking the Chair, thanked Mr. Dow and presented him with a memento of his year of office in the form of a gold watch. Mr. Dow suitably replied.

Mr. Rea referred to the loss sustained by the Association through the death of Mr. David Vass, late Engineer and Manager of Perth Corporation Gas-Works, an Honorary Member of the Association who took a deep and practical interest in their affairs. The members observed a minute's silence as a mark of respect.

A welcome was extended to seven new members. The two Papers, one of which will be found on later pages, were then presented, and after the discussion which followed tea was served in the College Common Room.

World Power Conference

Statistical Year Book

A new feature of the Second Number of the *Statistical Year Book* of the World Power Conference, which represents a further stage in the attempt of the Conference to publish international statistics of power resources, development, and utilization on a comprehensive and comparable basis, is the inclusion of annual statistics relating to coke and to the production and distribution of manufactured gas.

The task of preparing the tables and the definitions of the terms employed lasted just ten years. Experts in many countries were consulted through the National Committees of the World Power Conference, and a special Sub-Committee of the International Executive Council held a number of Sessions in 1932 and 1933. The definitions are reproduced in the text.

The new edition contains an inventory, based on the latest available information, of the fuel and power resources of the different countries, and annual statistics, relating to 1934 and 1935, of the production, stocks, imports, exports, and consumption of coal, brown coal and lignite, peat, coke, wood, petroleum, benzoles, alcohols, natural gas, manufactured gas, water power, and electricity. Statistics for about sixty countries are included, and, where practicable, continental and world totals are presented. The great majority of the statistics were specially compiled by the National Committees of the World Power Conference with the assistance of Government Departments and other organizations, and the use of the uniform tables and definitions adopted by the World Power Conference has ensured a high degree of comparability.

The volume, obtainable from the Central Office of the World Power Conference, 36, Kingsway, W.C. 2, price 20s. net, will prove of great value to engineers, economists, and statisticians, and to others interested in fuel problems.

Increased Sales at Glasgow

The following figures show the increases which have been recorded in the sales of gas at Glasgow since June 1 last:

—	Thousands Cu.Ft.			%
	1937.	1936.	Increase.	
June 1 to June 30, 1937 .	706,884	660,751	46,133	6·982
,, ,, ,, July 31, 1937 .	1,340,694	1,256,501	84,193	6·701
,, ,, ,, Aug. 31, 1937 .	2,075,596	1,952,132	123,464	6·325
,, ,, ,, Sept. 30, 1937 .	2,847,107	2,694,389	152,718	5·668
,, ,, ,, Oct. 31, 1937 .	3,755,628	3,576,015	179,613	5·023

Edinburgh's "Ideal Home" Exhibition

Comprehensive Gas Display

Among the 150 stands at the Edinburgh "Ideal Home and Food Exhibition," which was held in the Waverley Market from Oct. 30 to Nov. 13, were a number of attractive gas displays. These included exhibits by Ascot Gas Water Heaters, Ltd., W. H. Dean & Son, Ltd., R. & A. Main, Ltd., the Parkinson Stove Company, Ltd., and Radiation Ltd., as well as a stand devoted to Electrolux gas-operated refrigerators. Some 70,000 people visited the exhibition, and excellent business resulted in the co-operative effort by the Edinburgh Gas Department and the firms mentioned.

A large hall, capable of accommodating 160 people, was utilized each day for cinema shows and cookery demonstrations. Over 9,200 visitors viewed the latest B.C.G.A. films, while fully 4,000 people took advantage of the cookery demonstrations. Queues for the "gas pictures" had to be formed every evening to cope with the crowds, the demand for seats being in excess of the hall's capacity.

Good Cooking and Health

Rochdale Demonstrations

The advantages of automatic cooking were ably demonstrated at the recent cookery demonstrations arranged by the Rochdale Corporation Gas Department in conjunction with Radiation Ltd.

A very successful series of lectures given by Miss R. Pullin, of the Radiation Research Kitchen, on "New World" gas cookers, terminated with a cake-baking competition for which there were a large number of entries. When presenting the prizes for this competition, the matron of the local hospital emphasized the fact that with modern thermostatically-controlled cookers cooking was practically automatic and success assured.

As an example illustrating that standardized automatic cooking is advisable for the furtherance of good health, it is interesting to note that the kitchens of this hospital are equipped with "New World" gas appliances.

A Failure of Supply

Unusual Occurrence in Yorkshire

A very unusual occurrence in the history of gas is reported from Ossett, where a considerable number of homes were temporarily without a supply in the course of last week. It appears that a naphthalene stoppage in the mains leading from Crigglestone Colliery interrupted the supply of coke-oven gas, and supplies to consumers were affected. Energetic measures were taken to remedy the defect, including the clearing of 70 yd. of main, and gas was soon available again.

Combustion Efficiencies of Gas Engines

Institution of Civil Engineers' Paper

For more than twenty-five years the Author of a Paper delivered at a meeting of the Institution of Civil Engineers on Nov. 9, Mr. W. A. Tookey (Member), has had opportunity of observing the performance of gas engines in industrial service in many parts of the country. In the majority of cases, the power-output of an engine was computed from indicator diagrams, which also aided in diagnosing faults and estimating "tuning-up" effects. Not least of the problems solved in this work was the evolution of an indicator reducing gear which was capable of application to every type of single-cylinder engine whatever the length of stroke. Furthermore, the gear had to combine reasonable accuracy of movement with light weight. The gear evolved was described in an appendix to the Paper.

A further problem was to decide upon a basis of comparison which would permit the computation of mean pres-

Gas Lighted Indoor Bowling Green

The South Metropolitan Gas Company recently completed an all-gas installation at the Lewisham Club, High Street, Lewisham. Gas was chosen for the lighting of the indoor bowling green, and also for cooking, heating, and water heating purposes on the club premises. The bowling green, size 110 ft. by 50 ft., is illuminated by 24 "Swanley" lamps, each fitted with six No. 2 burners and special reflectors. The heating arrangements include four "Moderne" 9-burner radiators on the green and "Moderne" 5-burner radiators in each of the cloak rooms and a gas fire in the club lounge. The entrance, dressing rooms, lounge, and kitchen are lighted by "Surbiton" lamps, each fitted with two No. 2 burners. Water heating in the kitchen and cloak rooms is provided for by "Ascot" water heaters.

sure, from the planimetered area of the indicator-diagram, to be correlated with gas meter readings. With the very many types and sizes of engine met with in all stages of repair and disrepair, the usual statement of cu.ft. per I.H.P.-hr. (based on cylinder dimensions and number of impulses per unit time) gave no useful comparison of performance. It was found, however, that when the indicator mean pressure was taken as a fundamental unit representing power-output, and the rate of fuel consumption, computed from the gas meter readings, was expressed in terms of B.Th.U. per cu.ft. of total cylinder volume, the factor obtained by dividing mean pressure by mixture-strength gave a direct indication of thermal efficiency.

The total cylinder volume was in a sense a measure of the maximum air capacity at normal temperature and pressure per cylinder per impulse. The air-capacity of an engine cylinder decided the limit of its ultimate power, as the fuel, whatever its nature, merely provided the wherewithal to burn the oxygen contained in the air. The Author had found that engine attendants, having been misled by nomenclature, were prone to decide that a gas engine must necessarily require manipulation of the gas-regulating cock more or less according to the load, not realizing that there was a minimum and a maximum limit of combustibility, and, indeed, a very definite ratio of gas to air which gave maximum combustion-efficiency. It was the air-content that mattered most.

In hundreds of gas power installations—particularly those erected in pre-war days—those responsible for the lay-out had stultified the good working qualities of the engine by placing the exhaust-silencer close to the cylinder instead of, say, 12 or more ft. away. The kinetic energy of the waste gases leaving the cylinder was entirely lost when the exhaust-box was too close; when it was at a greater distance, the spent gases continued to flow at considerable velocity from the cylinder and, with the normal overlap in valve-timing, fresh air was then induced to follow through, scavenging the combustion-chamber and ensuring good combustion conditions for the next charge. It was evident that old doctrines needed new preachers, for it had apparently been forgotten that the James Atkinson scavenging engine of 1892 functioned with a definite length of exhaust-pipe before release to an expansion-chamber. Incidentally, the Author had upon occasion criticized principals of technical colleges who arranged exhaust-gas calorimeters in research laboratories as close to the engine cylinder as was practicable. They might have good reasons from a tutorial point of view, but they failed to realize that in such a position considerable back-pressure was set up, with consequent retention of heated exhaust-products within the combustion chamber. This seriously affected the efficiency of combustion, and also considerably restricted the mean effective pressure that would otherwise be obtainable when full charges of cool air refilled the cylinder.

The Tale of the Rates

Interesting Analysis of Municipal Rating

Once again we are indebted to the Preston Borough Treasurer (Mr. W. Allison Davies) for his Annual Statement—the 53rd of the series—which sets out the various rates levied in 354 municipal areas throughout England and Wales, together with interesting details regarding the appropriation of the rates in respect of the different municipal services, totals of populations, rateable values per head of population, together with particulars relating to gas, water, and electricity supplies.

While superficially presenting a rather alarming mass of figures, a closer study of this "tale of the rates" reveals many interesting facts, disclosing as it does the general trend of municipal affairs throughout the country. While the figures of rates levied in the pound must not be taken as necessarily indicative of the actual burden imposed upon the ratepayer in comparison with the corresponding figure for another town, they do, nevertheless, when set against the previous year's figure, demonstrate the general tendency in the area concerned—for where the figure in the pound may be high, the rateable value may be low, and *vice-versa*.

As we have pointed out, the real significance of the statistics set out in the statement can only be fully appreciated by comparing them with those of the previous year—and this occupation makes sad reading, unless it be an indication of an all-round improvement in municipal services. No less than 48% of the areas covered by the statement record increased rates as compared with the previous year; 16% show improvement, while the remaining 36% maintain their previous figures in the pound.

Of the 28 Metropolitan Boroughs included in the return, seven show increased rates, while six record decreases, Poplar still being the highest at 17s. 6d. in the pound (though it does show a reduction of 6d. on last year's figure). The lowest figure is again that of Westminster—at 9s. 9d. in the pound—a reduction of 1d. on last year.

Of the 84 County Boroughs dealt with the average rate has increased from 13s. 1¼d. to 13s. 5½d., a total of 38 recording increased figures and 15 decreases. The number of Boroughs included in the return is 147, of which 75 record increases and 14 decreases. In this case the average rate has risen from 12s. 1⅝d. to 12s. 4d. Of the 95 Urban Districts 49 show increases and 23 decreases. The relatively high percentage of decreases among this class of municipal authority appears to be due to a considerable amount of de-rating in various "depressed" areas—Abertillery having dropped by 3s. in the pound to 25s. The effect of this has been to lower the average over the whole class from 13s. 10½d. to 13s. 9⅞d.

Among the particulars of domestic supplies, the return gives the prices of gas per therm and per 1,000 cu.ft. within and without the individual districts, together with the declared calorific value of the gas supplied. Other details of interest are the estimated transfers from municipal undertakings to the relief of the rates, and, conversely, the estimated transfers to municipal undertakings in respect of deficiencies. It is gratifying to be able to find but three of the latter, so far as gas undertakings are concerned throughout the whole of the return, and these appear to make a total charge upon their rates of some £4,400. On the other hand, 18 municipal gas undertakings contribute an aggregate sum of over £101,000 (estimated) towards the relief of the rates—the Nottingham Gas Department still being the most generous in this respect with its estimated quota of £31,500. In this connection it should be stated, however, that the return is not intended to demonstrate the desirability or otherwise of municipal trading. Indeed, the large majority of municipal gas undertakings continue to direct their profits towards improved service and lower charges for their commodities.

Many other interesting facts and comparisons can be gleaned from the statement; suffice it to say, however, that a very profitable study may be made of Mr. Allison Davies' instructive figures.

North of England Auxiliary Association

Thirty-Fifth Half-Yearly Meeting

The thirty-fifth half-yearly meeting of the Auxiliary Section of the North of England Gas Managers' Association was held in the Gas Offices, Newcastle-on-Tyne, on Nov. 26—Mr. J. W. PALLISTER, of Middlesbrough, presiding.

The election of officers for the ensuing year resulted as follows:

Chairman.—G. Neil (Southampton).
Vice-Chairman.—G. J. Duncan (North Shields).
Hon. Secretary.—L. M. Weldon (West Hartlepool).

It was mentioned that the new Chairman, Mr. Neil, had considerable experience in the North of England before taking up his present position at Southampton. He was formerly technical assistant to the Walker and Wallsend Gas Company and was later appointed Assistant Works Manager to the Newcastle-upon-Tyne and Gateshead Gas Company. Before going to Southampton, he was Works Manager of the Hartlepool Gas and Water Company.

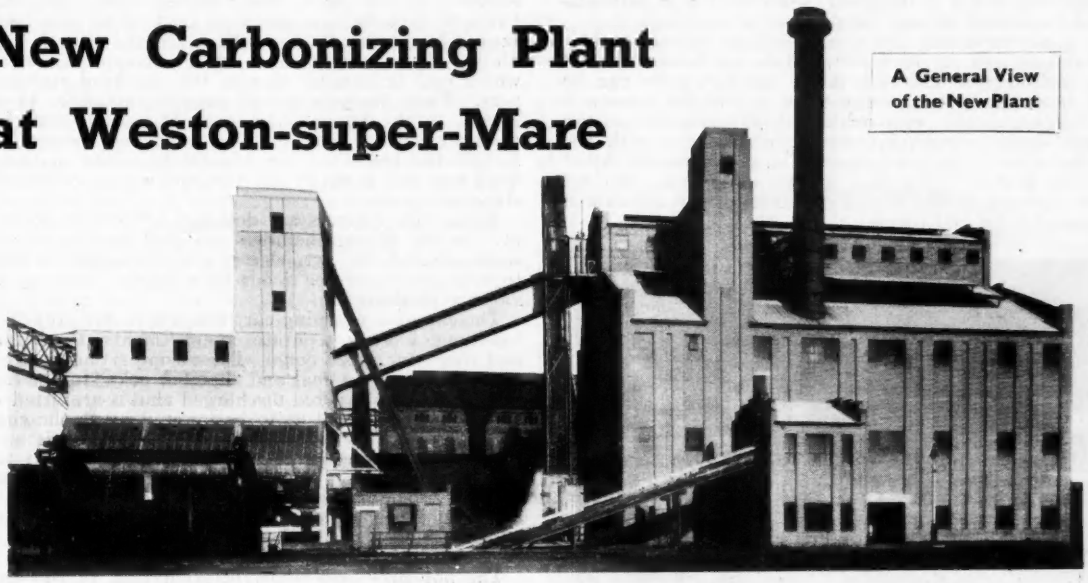
A Paper was then presented by Mr. R. Aynsley, of the South Shields Gas Company, entitled "Prepayment Meter Administration and Collection." This, together with a report of the discussion which followed, will be found on other pages of this week's "JOURNAL."

Presenting a certificate to the retiring Chairman, Mr. NEIL referred to Mr. Pallister's work for the Association. In reply, Mr. PALLISTER paid tribute to the Committee and in particular to the Hon. Secretary for piloting the Association to the conclusion of another successful year.

A vote of thanks to the officers was proposed by Mr. W. L. ROBERTSHAW (Sunderland), seconded by Mr. A. O. OLD (West Hartlepool). In acknowledgment, Mr. Weldon said it was with regret that the Association was to lose both Mr. Pallister and Mr. Robertshaw, but it was with pleasure that they saw them going forward to the Special Purposes Section. The Association had of late lost several members by removal to other districts and by advancement to the Senior Association. He appealed to the members to encourage the young men to join the Auxiliary Section.

The meeting concluded with tea taken at the Imperial Restaurant, Newcastle.

New Carbonizing Plant at Weston-super-Mare



A General View of the New Plant

New carbonizing plant, comprising three settings of Woodall-Duckham intermittent vertical chamber, together with coke-handling plant, was officially inaugurated to-day at the Works of the Weston-super-Mare and District Gas Company by Sir Harold Hartley, C.B.E., M.C.

In view of the increased gas requirements due to the Company's rural area developments, the Board gave consideration about three years ago to the question of replacing the horizontal retorts, then in use, with a more modern and efficient plant. The results from the horizontal retorts had been for many years adversely affected by the serious settlement of their foundations which had taken place, and this same trouble had prevented the adoption of improved methods of handling materials.

Careful attention was given to the possibility of utilizing the existing retort house by providing a modern horizontal retort bench, or, alternatively, vertical retorts in one half of the house. It was found that the provision of satisfactory foundations would be so difficult and so uncertain, particularly with routine operations proceeding in the remainder of the house, that it would be unwise to attempt it. It was decided, therefore, that the scheme must provide for carbonizing plant on a fresh site parallel to the existing retort house.

Consideration of carbonizing systems which followed necessitated close attention being given to the various types of coal to be used, including the Somerset coals with highly swelling properties. Machine stoked horizontal retorts would enable any type of coal to be used, and considerable economies could be obtained by improved efficiencies of operation and by reduced labour charges. Certain disadvantages were to be anticipated, however, if foundation settlement were to occur. Continuous vertical retorts would give high thermal yields, with excellent coke and low labour requirements, but would not readily carbonize Somerset coals except at a low rate of throughput. Settlement of the foundations, if it were experienced, might be particularly disadvantageous. Intermittent vertical chambers offered advantages which on examination proved to be particularly desirable for the conditions at Weston-super-Mare. They would carbonize any types of coals and give good thermal yields. The coke quality would be similar to that to which the customers of the Company were accustomed, and the labour requirements were low. Examination of carefully compiled balance sheets, relating to different carbonizing systems, showed that the intermittent vertical chambers offered satisfactory financial advantages. Tenders were then invited for plant in accordance with the specification and plans of the Company's Engineer and General Manager, and the tender of the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., was accepted.

Foundations Call for Special Care.

Difficulties likely to arise in connection with the foundations called for special care, not merely in the choice of plant, but also in its disposition. The existence of a bed of peat at a depth of over 80 ft. was a matter of much concern, as it was felt that some settlement of the foundations might utlimately develop, although the calculations of Sir Cyril Kirkpatrick and Partners, the Consulting Engineers for the foundation work, indicated that it might be slight in extent. This possibility was a contributing factor which resulted in the decision to dispense with recuperators and to spread the load over a greater area by building the producers separately from the settings. By the use of breeze for the producer fuel and the greater recovery of steam from the waste gases, it was estimated that full compensation would be obtained for the absence of recuperation.

Another feature of the plant is that provision is made for coal blending in the future, if a high degree of uniformity in coke quality is required.

Coke stocking and reclaiming are provided for by utilizing the existing overhead telpher plant, and a future extension of the telpher track will enable the stacking and reclaiming of coal to be carried out mechanically.

The new installation comprises three settings, each containing five latest-type non-recuperative W-D intermittent vertical chambers. The gas used for heating the chambers is made in an independent battery of three producers situated at ground level at one side of the bench. The installation is provided with complete coal and coke handling and coke screening and storage plant and with a waste heat boiler, and is erected in a new steel-framed brick-panelled retort house of striking modern design. The retort house and coal and coke equipment have been made large enough for an ultimately extended plant of 25 chambers, and the necessary provisions have been made in the design of the settings to facilitate such an extension. The Woodall-Duckham Company have been responsible as main contractors for the whole installation, including the foundation work.

The chambers are charged and discharged at intervals of about 12 hours, and in these circumstances the plant has a maximum daily capacity of 109 tons of coal and can produce approximately 1,560,000 cu.ft. of gas. The chamber walls and heating flues are constructed in silica and are finished at the top and bottom with a course of fireclay blocks.

The chambers are the first large capacity chambers in this country to be designed for non-recuperative heating, only one other non-recuperative intermittent chamber plant having previously been built which consists of small capacity chambers of similar design. Certain advantages can be obtained by the elimination of recuperators. First, the troubles and high maintenance costs associated with these structures are avoided. Secondly, it enables the producers to be built in an independent battery, their size then being no longer limited by the necessity to fit them into composite settings of chambers, recuperators, and producers. They can thus be designed to burn a coke and breeze mixture, with consequent savings in saleable coke. Thirdly, the fullest use can be made of waste heat boilers, and the very greatly enhanced output of steam is achieved with a comparatively slight increase in fuel consumption in the producers. The overall thermal and

economic efficiency of the plant, considered as a carbonizing and a steam raising installation, is improved.

The three producers are arranged in a battery at floor level at one side of the bench. They are interconnected by a common producer gas main, so that gases can be taken from any of the producers to any of the three settings, arrangements being made so that any producer can be shut down without interfering in any way with the working of the other producers. The producers are fitted with step grates. They have a total grate area sufficient for the heating of the fifteen chambers when utilizing a mixture of coke and breeze.

Chamber Top Platform, showing the Charging Car, Gas Offtakes, and top Collecting Main.

The producer gas enters a horizontal heating flue at the bottom of the chamber and at the inlet to this flue meets secondary air, which has been slightly preheated in the front wall of the setting. The hot combustion gases then pass up from each bottom flue to the top of the setting, some travelling indirectly backwards and forwards through a series of horizontal flues along the full major axis of the chamber, and the rest flowing upwards through by-pass openings. The temperature is even from end to end of the horizontal flues.

Facilities are provided for the admission of secondary air at various levels in the heating flue as desired. The flue temperatures at the tops of the chambers are lower than at the bottom, but the decrease in the minor axis of the chambers from bottom to top acts as a counterbalancing factor, and the charge of coal is carbonized equally throughout the full height. From the top heating flues, the hot waste gases pass into a collecting flue in the front wall of each setting and thence out through necks into the waste gas main.

A special feature of the bracing of the setting is the use of water cooled tie-rods through which softened water flows to the waste heat boiler feed tank. These tie-rods contribute to the efficient support of the chambers by the buckstays and the bracing, and thus maintain the brickwork tight under varying conditions of working.

Coal and Coke Supply.

Coal is brought into the works in railway wagons on the private siding which connects the works to the main line of the Great Western Railway Company at the Weston-super-Mare station. All wagons entering or leaving the works are weighed on a 40 ton weighbridge, provided with sunk rails, the large level platform thus formed rendering it available for weighing heavy road vehicles. The works sidings have a total length of 650 yards, the necessary shunting of the coal and other wagons being dealt with by a Peckett steam locomotive.

The coal used in the new carbonizing plant is discharged by means of a side-discharge wagon tippler of the automatic clamping cradle type into a 24-ton steel receiving hopper. The bottom discharge outlet of this hopper is fitted with a rotary feeder to give an even feed of coal to a 24 in. belt conveyor, approximately 120 ft. long, which delivers coal to a breaker, arranged on an elevated structure. The belt conveyor can deal with 30 tons of run-of-mine coal per hour, and the breaker, which is of the Jeffrey "Flextooth" type, is capable of breaking 25 tons of coal per hour from a maximum size of 14 in. cube to a product of maximum size $\frac{3}{4}$ in. cube. A static screen in the delivery chute to the breaker passes coal under $\frac{3}{4}$ in. to a by-pass chute, while provision is also made for completely by-passing the breaker when nut coal is used.

From the breaker and by-pass chute the coal is received by a 30 tons per hour cased-in bucket elevator, which raises it to the top of the chamber house and there delivers it to a 30 tons per hour push plate conveyor, arranged longitudinally above the overhead storage hoppers. Sliding doors are fitted to this conveyor by means of which coal is distributed into the overhead storage hoppers. These hoppers are of capacity equal to 48 hours' supply to the fifteen chambers. The small coke for the chamber bottom pads and the coke and breeze used as fuel in the producers are separately stored in two overhead hoppers, forming an extension of the overhead coal storage hoppers.

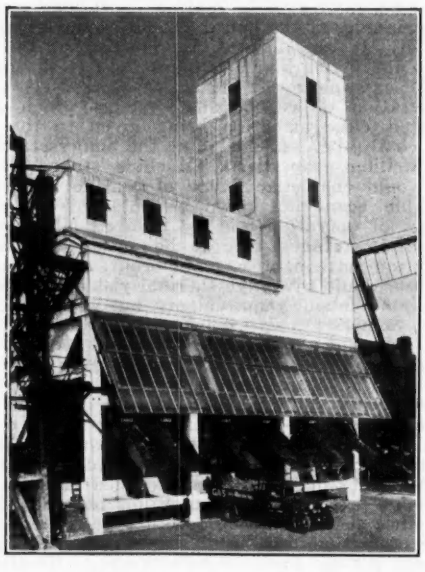
These coke hoppers are designed to hold 48 hours' supply for the fifteen chambers and the three producers respectively. A 30 cwt. electrically driven lift is provided to take passengers or goods from ground level up to the various platforms.

The chamber charging car, which is motor-propelled and top-hung, has six separate compartments, three for coal and three for small coke. These compartments are filled from the overhead coal and chamber coke storage hoppers respectively. Tapered discharged chutes are fitted to the hoppers, so arranged as to be lowered on to the chamber charging holes to prevent spillage. Provision is made to ensure rapid charging and even distribution and to prevent the coal being charged before the coke pad has been dropped. The small coke is dropped into the charging holes and forms a pad about 12 in. deep. The coal is then immediately charged, the whole process occupying about 30 sec.

The hot coke skip is of special design, of the bottom-discharge type, and capable of holding the discharge from one chamber. It is hauled, by means of an electrically driven winch, arranged at the end of the house, into a quenching tower. Here a series of overhead water sprays pass a predetermined quantity of water on to the hot coke.

After quenching, the coke skip is hauled into the yard and discharged into a concrete coke receiving hopper arranged below ground. This hopper is lined with pressed blue tiles set in cement and is fitted with arrangements for delivering coke to an automatic skip hoist which forms the first link in the coke handling and screening plant.

Each chamber is fitted with top and bottom gas offtakes. The pull in the foul main is controlled by a gas governor of the "B.K." type, made by W. & B. Cowan. This is a non-relay governor, totally enclosed, with valve counterbalanced by the bell, further sensitivity being attained by the lightness of working parts. The foul main is also fitted with a "Peebles" automatic safety relief



The Coke Screening Plant from the south side, showing the Skip Hoist and the arrangements for loading the Coke into Road Vehicles.

valve, with a vent pipe carried up above the roof to atmosphere.

Provision is made to utilize the bottom off-takes for the admission of steam to the chamber for steaming the charge.

Waste Gases.

In order to obtain the fullest benefit from the elimination of recuperators in the design of the settings, special attention has been paid to the recovery of waste heat from

the combustion gases from the heating flues of the chambers. These are taken out into a waste gas main, which consists of a circular steel casing lined with insulating brick and insulating firebrick and is fitted with rectangular branch connections from the settings constructed of similar material. This main normally takes the gases to a waste heat boiler, though a by-pass is provided direct to the chimney.

The chimney is of steel, lined throughout with firebrick, and is of ample size to deal with the waste gases from a finally completed plant of 25 chambers when working on natural draught. It is provided with an automatic draught regulator to ensure an even draught on the settings when working on natural draught, irrespective of atmospheric conditions.

The waste heat boiler is of the W-D horizontal firetube induced-draught type, designed for a working pressure of 120 lb. per sq.in., and is large enough to deal with the whole of the waste gases from the fifteen chambers. It is provided with a turbine-driven waste-gas fan at the outlet and with a superheater at the inlet, capable of raising the steam to a final temperature of 450° F. The boiler is fitted with all the necessary steam and water mountings and fittings, including a high and low water alarm and a " Thermofeed " water regulator.

The feed water for the boiler, including that which passes to the feed water tank by way of the water cooled tie-rods, is previously softened by means of a " Neckar " water softening plant of the lime-soda type, this plant having a capacity of 1,300 gal. of water per hour. The softened feed water is heated by means of an enclosed tubular type feed-water heater working on exhaust steam from the fan turbine, and two vertical single-cylinder direct-acting feed-water pumps are provided, one acting as a standby.

Coke Handling and Screening Plant.

A very comprehensive coke handling and screening plant has been installed to deal with the coke produced in the intermittent vertical chamber installation. As before mentioned, the coke, after being quenched, is discharged to a receiving hopper below ground. This hopper is fitted with a special automatic chute and cut-off valve, for filling coke to a skip hoist. This skip hoist is of the fully automatic balanced type, electrically-driven, and is capable of handling 15 tons of coke per hour. The cut-off valve on the filling chute is controlled by the movement of the skip hoist, so as to obviate spillage of coke.

The skip hoist delivers the coke to a reinforced concrete buffer hopper forming part of the reinforced concrete structure of the screening and storage plant, at the top of which it is situated. A rotary feeder at the outlet ensures even feed from the buffer hopper to the primary screen, being driven by the motor actuating this screen.

The primary screen is of the Corts reciprocating perforated plate type, and acts as a scalping screen, removing all coke below $1\frac{3}{4}$ in. in size. It is capable of dealing with 15 tons of coke per hr.

The undersize coke passes through a delivery chute on to a 6 ton per hr. belt conveyor 90 ft. long by 14 in. wide, which takes it back to the chamber house and delivers it either to the producer coke hopper or the chamber coke hopper as required. The oversize coke from the primary screen is passed either through a Phœnix type adjustable cutter of 15 tons per hr. capacity, or direct to a secondary screen of similar hourly capacity. This screen is of similar type to the primary screen, but is 38 ft. long by 30 in. wide. The screen plates are arranged to grade the coke into five sizes—Breeze 0-$\frac{3}{8}$ in., No. 1 Nuts $\frac{3}{8}$ in.-$1\frac{1}{2}$ in., No. 2 Nuts $1\frac{1}{2}$ in. to 2 in., Large Broken Coke 2 in.-3 in., and large Coke over 3 in., and to distribute these sizes into the appropriate storage bunkers beneath.

These bunkers are of reinforced concrete, forming part of the main coke plant structure. They have a total storage capacity of 150 tons of coke and breeze. The No. 1 Nut Coke compartment has four outlets, two on each side, while the other three compartments each have two outlets, one on each side. All outlets are provided with quadrant doors.

Two Pegson hand-travelled debreezing units are provided to receive the coke from the bunker outlets and remove breeze. Each has a fine breeze hopper with quadrant discharge door, and also has a chute for by-passing the screen when receiving breeze from the breeze compartment. Five two-way chutes are fitted on one side of the bunkers for delivering the various coke sizes from the debreezers alternatively into road vehicles or into bags, a concrete bagging platform, with a portable Belle Isle coke weighing and bagging machine, being provided on this side. A single chute is provided opposite the breeze compartment on this side for loading to road vehicles only.

On the opposite side of the bunkers, six two-way chutes are provided for delivering the various coke sizes and breeze alternatively to railway wagons or a belt conveyor. The chutes to railway wagons are hinged and balanced so that they can be raised to clear high-sided wagons.

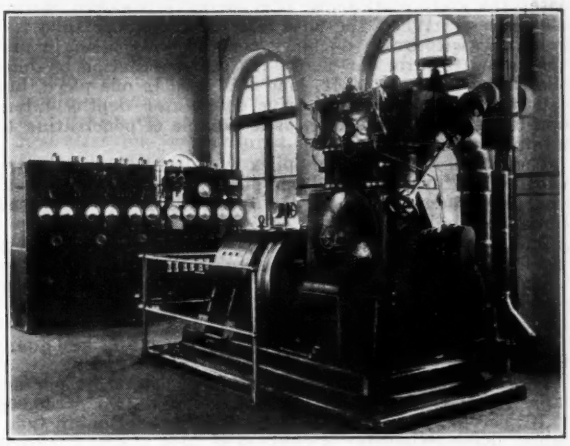
In addition to the concrete bunkers, all the steel hoppers and delivery chutes on the screening plant are lined with pressed blue tiles, and a special anti-breakage chute is provided to take delivery of the large coke over the end of the secondary screen into the large coke compartment of the bunkers.

Power and Steam Supply.

All power driven units on the coal handling and coke handling and screening plants are actuated by electric motors, as are also the liquor pumps, quenching pumps, and lift. The motors on the coke handling plant are provided with electrical sequence interlocks so as to prevent these units from being started or stopped out of their proper order. All motors are of the totally-enclosed dust-proof gas-works type.

The waste heat boiler fan and feed water pumps, the hydraulic pumps, and the pump supplying the water-cooled tie-rods for the bottom door gear are steam-driven, the exhaust steam from the fan turbine being used in the feed-water heater.

The whole of the steam required for the chambers, producers, and steam-driven units is generated in the waste heat boiler, and there is a considerable surplus available for other works purposes.



The 100 kW Electric Generating Set and Main Switchboard.

Buildings.

Considerable attention has been given to the outward appearance of the buildings housing the various portions of this plant. The chamber house is an imposing steel-framed brick-panelled structure designed in accordance with the modern " vertical " style. It is a matter of some difficulty to house in an attractive and yet economical manner the somewhat irregular shapes combined in a completely equipped modern carbonizing plant. By careful designing and planning of voids, wall space, and vertical features, an attractive result has been obtained, and this has been enhanced by special pointing of the brickwork.

The reinforced concrete structure which forms the coke screening and storage plant has also been designed with a view to its external appearance, and features have been introduced which cause the design to harmonize with that of the chamber house.

Within the chamber house a room has been built to enclose the liquor pumps. A similar room is also arranged to house the lift motor, the quenching pumps, the hydraulic pumps, the tie-rod water pumps, the boiler-feed pumps, and the switchboard. A further house is provided to enclose the haulage gear for the hot coke skip and the tippler control gear. The elevated coal breaker is enclosed in a steel-framed brick-panelled house conforming in design with that of the chamber house.

A portion of the chamber house at the top of setting level has been enclosed to form messing and lavatory accommodation for the men employed on the plant.

Piling and Foundations.

The site conditions presented a very difficult problem. The strata underlying the site are made up of soft grey clays and silty sand to a depth of almost 50 ft., where a bed of sand of somewhat better quality commences and extends for a depth of about 25 ft. Very serious troubles

have been encountered in the past due to considerable settlement of earlier plants and, after a very careful review of past experience with various types of foundations, it was decided to utilize Franki compressed piles to support the foundations, since it was believed and subsequently proved that these piles would take a safe bearing on the top of the sand stratum commencing at a depth of 50 ft.

The buildings and structures therefore have been founded on 109 Franki compressed piles, approximately 50 ft. in length and 22 in. in diameter, with a compressed bulb at the base varying from 4 ft. to 4 ft. 6 in. in diameter, the whole pile shaft being reinforced with longitudinal bars and spirals.

The method of installation of these piles was interesting and unusual, since during the initial sinking of the driving tube the hammer blows were taken at the point and not at the head. The force of the hammer blow was taken first on a concrete plug at the point of the tube, and transmitted to the tube by friction, the magnitude of which can be gauged from the fact that the blows absorbed were delivered by a 46 cwt. hammer falling freely 20 ft. After the tube had been driven to the necessary depth, it was clamped at the head, and the driving plug at the point driven out. Concrete was then introduced and hammered by the 46 cwt. hammer to form the enlarged base, the steel reinforcing cage being introduced during the process. When the base was complete, the tube was gradually withdrawn as more concrete was filled in and hammered to form the shaft. In the installation of these piles a driving tube 50 ft. long was used in one piece, but had it been necessary to drive to greater depths extension tubes would have been used capable of penetrating to a total depth of 120 ft.

The Franki compressed piles were installed to carry a load of 80 tons each, and one pile was tested with a dead load of 120 tons, when the permanent set observed amounted to $\frac{1}{8}$ in.

The tops of the piles are provided with reinforced concrete caps, tied together with reinforced concrete beams.

The various pits are also of reinforced concrete, supported on piles.

The firm of Sir Cyril Kirkpatrick & Partners acted as Consultants to the Gas Company for the piling and foundation work.

There are three exhausters, one of 80,000 cu.ft. per hr. capacity of G. Waller & Co.'s make, and two of 40,000 cu.ft. per hr. capacity, made by the Bryan Donkin Company. Each exhauster is controlled by a steam governor and is fitted with an air blower to provide for the revivification of the iron oxide in the purifiers.

There are two sets of reciprocating gas compressors, both being Bryan Donkin Co.'s twin cylinder vertical steam engines working in tandem with gas cylinders. One set is capable of delivering 60,000 cu.ft. and the other 20,000 cu.ft. gas per hr. against pressures of 20 and 10 lb. per sq.in. respectively. They are used to supply the outer districts, but by the inter-connection of the mains also provide stand-by plant for the high-pressure boosting main in the inner area. The high-pressure main for the inner area is supplied from duplicate reciprocating compressors, which adjoin the carburetted water gas plant, and they, in their turn, provide a standby for the main for the outer areas.

Electric Generators.—The electric generating sets produce the whole of the electric power used throughout the works. The current used is 220 volts D.C., and the generating plant consists of:

One 100 kW Laurence Scott and Electromotors, Ltd., generator, driven by a Sisson & Sons' double crank steam engine.

One 50 kW Laurence Scott and Electromotors, Ltd., generator, driven by a Sisson & Sons' single crank engine.

One 25 kW British Thomson-Houston generator, driven by a Sisson & Sons' single crank engine.

The sets are arranged to work either singly or in parallel, as may be required.

The electric switchboard is of General Electric Company's manufacture, and is of five panels, complete with the usual indicators and recorders.

The gas gaugeboards consist of six polished enamelled slate panels, on which are mounted gas pressure indicators and recorders, calorific value indicators and recorders, sulphuretted hydrogen indicators, &c.

Two Livesey type washers for tar extraction are provided. One is a standard washer made by Kirkham, Hulett & Chandler, and the other is of W. C. Holmes & Co.'s manufacture. They are each capable of dealing with 2 million cu.ft. of gas per day and may be worked singly, in parallel, or in series.

For ammonia extraction, a Holmes brush washer and a Wilton's static washer are used, each of 2 million cu.ft. per day capacity.

At the main inlet to the purifiers, and also at the inlet to the catch purifiers, Ashwell & Nesbit's steam heaters are provided for raising the temperature of the gas during cold weather, to assist the oxide purification process.

On the inlet of the holders a Holmes brush washer, having two six chamber sections, is provided. The first section is fed with calcium chloride solution for the purpose of "drying" the gas, and the second section is used for naphthalene and benzole extraction by the use of gas oil as the washing medium.

The amount of crude benzole obtained is approximately 1·84 gal. per ton of coal. Two 18-in. Parkinson & Cowan water loaded balance type governors control the supply of gas to the town. One governor feeds a 24 in. main supplying the centre, northern, and eastern portions of the town, while the other discharges into an 18 in. main for the south and westerly districts.

Duplicate gas boosting plant is provided in the governor house, capable of giving an increase of 11 in. pressure to 250,000 cu.ft. of gas per hr. One booster is driven by a 17 b.h.p. Crossley gas engine, the other being driven by a pipe ventilated electric motor.

Prosperity Returning to South Wales

Wales and Monmouthshire Association Meet B.R.T.A. at Lunch

The great improvements in South Wales industrial prospects were graphically described by Major E. Ivor David, President-Elect of the South Wales Institute of Engineers, on Nov. 23, when, at a lunch given by the British Road Tar Association and the Wales and Monmouthshire Association of Gas Engineers and Managers at the Park Hotel, Cardiff, he proposed a toast to the prosperity of South Wales trade.

After stating that at one time nothing could apparently prevent the continuance of the decline of the Welsh coal industry, and the chief steel works were represented by dilapidated buildings and rusting machinery, he went on to congratulate, as a road user of more than 40 years' experience, the Association on its contribution to the prosperity of trade and the improvements in road surfaces which the Association had produced in the last few years. The sale of the by-products of the Cardiff Gas-Works was a valuable contribution to the trade of the area.

The Lord Mayor of Cardiff (Alderman O. C. Purnell, J.P.), responding, said that prosperity was dependent on the scientific research in what could be done in the coal industry and on the co-operation of all the industries.

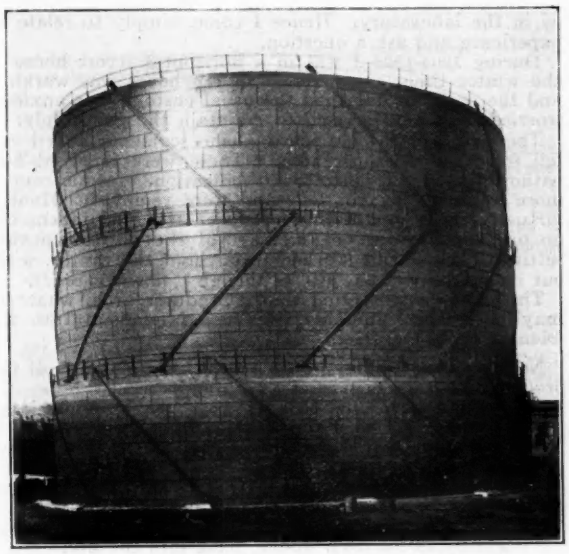
Mr. Norman J. McNeil (President of the Cardiff Incorporated Chamber of Commerce), proposing a toast to the Association, also congratulated them on their splendid work in improving the roads and in other directions. The South Wales coal trade owed a debt of gratitude to the Association for developing the use of that by-product of coal. The Association could play a great part in making the roads non-skid, durable, and safe.

Mr. J. Davidson Pratt, O.B.E. (Chairman of the Association), responding, referred to the value of tar to the dyeing industry, medicinal products, disinfectants, the materials for timber preservation, the new synthetic products, and first-class roads.

Tar should not be regarded as a by-product, but as a raw material of tremendous potentialities which it was one of the objects of the Association to develop.

Among those present were Mr. H. D. Madden (Chairman of the South Wales Board of the Association), who presided, supported by the Lord Mayor of Cardiff (Alderman O. C. Purnell, J.P.), Messrs. J. Davidson Pratt, J. Macleod Carey, E. J. Fottrell, Ewart R. Evans, W. J. Hadfield, W. E. Cone, Octavius Thomas, J. Stephenson, R. J. Rogers, R. J. Auckland, and others.

Gas-Works Extensions Inaugurated at Rawmarsh



The New Holder.

NEW OFFICES AND HOLDER

Considerable progress has been made by the Rawmarsh Urban District Council's Gas Department during the past two years, and the facilities were further improved last Saturday afternoon, when offices and a new gasholder were officially opened by the Chairman of the Gas Committee (Councillor W. T. Turner).

The offices have been made necessary by the greater activity of the Department, and with the new spiral guided holder, which has a capacity of 450,000 cu.ft., the undertaking will now be able to meet all demands for industrial and domestic consumers in Rawmarsh and Parkgate.

Gas for industrial purposes is comparatively new at Rawmarsh, but in this respect the Department is going rapidly ahead, while the consumption of gas for domestic purposes shows an increase of over 12% compared with two years ago.

Among those present at the gathering on Saturday afternoon were Councillor F. Jackson (Vice-Chairman of the Gas Committee), Councillor W. McNally (Chairman of the Council), Mr. A. H. Jackson (Clerk to the Council), Dr. C. W. A. Lister (Medical Officer of Health), Mr. J. Powdrill (Gas Engineer and Manager), Mr. W. H. T. Johns (Gas Engineer and Manager to the Rotherham Corporation), Mr. J. W. Brearley (Gas Engineer and Manager to the Swinton U.D.C.), Mr. E. J. Wellens (Gas Engineer, Manager, and Secretary to the Wombwell U.D.C.), and Mr. C. Davidson (of Messrs. R. & J. Dempster, Ltd., of Manchester, the contractors responsible for the new holder).

Before turning on the gas supply for the new holder, Councillor Turner said it was 47 years since the gas-works were opened at Rawmarsh. The annual output then was 10 million cu.ft. To-day, the Department was sending out something like 90 million cu.ft. of gas annually. The new holder had been erected after very careful consideration, and it had more than sufficient capacity to ensure an adequate reserve to meet the maximum demands of the district.

Interesting facts connected with the new holder, said Councillor Turner, were that it stood 75 ft. high, contained 177 tons of steel and over 173,000 rivets and 5,000 bolts.

It was his hope that the Department would continue to make progress, and he thought there was little doubt that this would be done, following the action of the Council in reducing the charges. Councillor Turner referred to the fact that in the past two-and-a-half years a debit balance of £1,162 had been turned into a credit balance of £1,800.

After the inspection of the holder, the guests were entertained at tea, Councillor W. T. Turner presiding.

Councillor W. McNally, proposing the success of the Gas Department, reviewed the undertaking's position and paid tribute to Mr. J. Powdrill.

Councillor F. Jackson, C.C., responded on behalf of the Gas Department, and said gas was a modern necessity for the health and well-being of the nation. He had been forcibly impressed by the possibilities of extended uses for gas in the future.

Councillor J. H. Humphries (Vice-Chairman of the Council) proposed the health of the contractors, and spoke of the efficient and sound way in which they had carried out the contract for the new holder. It was 47 years ago to the day since the original gas-works were opened, and Messrs. R. & J. Dempster were the original contractors at that time, and had now risen to be one of the leading gas engineering firms in the country.

Mr. C. Davidson, who responded for the contractors, remarked that their endeavour was to uphold their reputation by setting a very high standard of workmanship, and giving the best possible job. All credit was due to the Engineer and Manager, who knew what he wanted and had drawn up the specification in such a manner that a first-class job was ensured. Mr. C. Davidson presented Councillor Turner with a silver tankard as a memento of the occasion.

Mr. A. H. Jackson (Clerk to the Council) proposed the health of the visitors, and Mr. E. J. Wellens, who responded, paid tribute to Mr. Powdrill and to the foresight of the Council in extending the scope of the Department.

The Chairman said it gave him a great measure of satisfaction to be able to show what Rawmarsh was doing and had done to keep gas in the position of "Public Servant No. 1."

Athletic and Social

Cardiff Boxers Supreme.

Three Welsh champion amateur boxers successfully opposed a trio of London divisional title-holders on Nov. 25 at the Stadium Club, London. Two of these three triumphant Welshmen are employed by the Cardiff Gas Light and Coke Company. They are Jack Pottinger and Cyril Gallie, of whose fighting Col. T. H. Wand-Tetley, of the Army B.A., said it was among the best seen since the war.

Pottinger beat Alf Garrett (*The Times*) on points; and Gallie outpointed Chris Waitson (*The Times*) after one of the finest amateur displays seen in London for years. Gallie's display on Thursday will mean a lot to the tournaments at which he is due to appear this week—at the Albert Hall and the "television show" at the Alexandra Palace.

As most of our readers are already aware, the Cardiff Gas Light and Coke Company has a very fine Athletic Club, where athletic members train the young sons of employees in all sorts of sports, including Indian clubs, fencing, and very largely boxing. This Junior Athletic Section gives quite a number of displays for charitable objects in Cardiff, and the Company are justifiably very proud of the development of the scheme.

Dublin Staff Dance.

Over three hundred persons attended the fourth annual staff dance of the Alliance and Dublin Gas Company held in the Company's D'Olier Street premises. A notable gathering included the Lord Mayor of Dublin and many representatives of trade and commerce in the Free State capital.

Glover & Main Dinner.

The London Staff of Messrs. Glover & Main, Ltd., held their Eleventh Annual Dinner and Dance on Saturday, Nov. 13, at the Chiltern Hall, Baker Street, 160 members and their friends attending. Owing to the unavoidable absence of Mr. Kenneth Aird, the chair was taken by Major A. L. S. Wood, who was supported by Mr. S. E. Wood and Sir Ernest Hiley.

At the conclusion the Chairman gave a lead in an entertaining speech, which was ably maintained by subsequent speakers. Sir Ernest Hiley, in proposing the Toast of "The Staff," paid a charming tribute to their work. He also spoke of the forty-six years' excellent service which Mr. F. Edis had given, and expressed the hope that the well-earned rest of his retirement would hold for him many years of happiness. In reply, Mr. Edis spoke of the way in which the company had grown with the Industry, and gave many recollections associated with that development. Responding to the Toast of "The Visitors," Mr. W. A. Howie gave some amusing sketches of experiences in a Gas Engineer's life. A most enjoyable evening was concluded by dancing until midnight.

Institution of Gas Engineers

Further Written Contributions

Written Contributions and Reply to the 28th Report of the Refractory Materials Joint Committee presented at the Autumn Research Meeting of the Institution, Nov. 2 and 3.

Communication No. 169

Mr. FRANK WEST (Friden) wrote: I should like to congratulate Mr. Green and his Staff on the excellent Report submitted. I feel sure that everyone will agree that the scope of the investigations is remarkably wide and the results presented should be of considerable value to the Carbonizing Industry.

As Vice-Chairman of the British Refractories Research Association, I should like, in passing, to refer to the changes that have taken place during the year—viz., the retirement of Dr. Mellor and the appointment of Mr. Green as Director. I feel sure we all welcome Mr. Green in his new appointment and wish him success in the future. Some remarks on Dr. Mellor's activities in the past are given on p. 3, so it is not necessary for me to refer to them in detail. Considerable extensions and modifications to the laboratories have been carried out during the year, and I may say that, considering its size, the Research Association has now in its premises, equipment, and Staff an instrument for technical research second to none in the country.

This Institution and gas undertakings have played a considerable part in the forging of this instrument, and the Research Association fully appreciates your financial support in the past and hopes it may be maintained. It is a wise policy nowadays to consider the support given to research as an investment, and the greater the investment the greater the yield in benefits to the Industry.

There are several points in the Report which appeal to me as a member of the Institution. The light which is being thrown on the disruptive effect of hydrocarbons on firebricks at certain temperatures will be very useful in explaining some of those peculiar failures of firebricks in certain portions of carbonizing installations. The steady progress which is being made in the exploration of certain features connected with jointing cements is noteworthy and I would like to stress particularly the marked reduction in strength of those joints which have been heated under slight tension. This point should be carefully considered in design of settings since leakage through faulty joints is a serious menace to the efficiency of the carbonizing unit.

Once again we have interesting data reported on the action of alkalis, data which have an important bearing, for instance, on the zonal effects noted on the refractories in vertical retorts. Another feature of the problem of testing the behaviour of refractory materials under load is presented in the Report. The data are of particular interest in relation to the problem of the standardization of testing procedure. The summing-up on the whole of the results of this investigation will be awaited with interest.

A new feature which is of great importance to the Gas Industry is the first Report on the Action of Slags on Refractory Materials. The preliminary results of this well-conceived investigation are laying the foundation for the more complete understanding of the mechanism of slag action. Any knowledge which leads to improvement in the slag-resisting capacity of refractories and aids in the selection of refractories to withstand certain conditions will be welcome to manufacturers and users.

From the manufacturing point of view the Reports on the methods of obtaining increased conversion to tridymite in silica bricks, and the preparation of refractory materials of high porosity are of great interest, especially in the case of the latter, as refractory insulating materials are becoming so increasingly useful for industrial furnaces using all types of fuel.

From a general survey of the Report one forms a high impression of the value of the work carried out and its usefulness to this and other industries.

Mr. H. J. TOOGOOD (Hampton) wrote: On first reading this Paper I was intrigued with the phrase (half-way down page 81)—"The slag flowed into the nostrils, where it froze," an expression so realistic that one must either visualize "the flame that freezes" or realize the potency of the slogan.

Further reading, however, showed that this Paper stands unique, inasmuch as the Author appears to be alone on his minaret calling to the faithful in carbonization, and so clear is his voice that it is heard as well in the retort house as in the laboratory. Hence I come, simply to relate an experience and ask a question.

During 1905-1906 I was in a horizontal retort house in the winter time, every retort in the house was working, and the staff, as was then the usual custom, was anxious, worried, and hard-pressed to maintain the gas supply.

Then an accident happened—some segments fluxed and fell from the producer arch. These were removed hot, without any disturbance to carbonization. In due course, more segments fluxed, fell, and were removed. Finally, virtually the whole of that producer arch had fallen, but no one thought for one moment of shutting down that setting. The setting worked throughout the winter, without its producer arch, just as though "now't w'ere".

Thus was demonstrated that a producer arch, whatever may be its real function, was not fundamental to the science of carbonization.

Now, in a horizontal retort setting, the omission of the producer arch offers several advantages:

(i) Reduction in first-cost (say, 5 per cent. in large settings and 8 per cent. in small settings).
(ii) Reduction in thermal capacity of setting, hence economy in fuel.
(iii) Reduction in wear and tear, since the cutting action is less from the slower-moving producer gas.
(iv) Reduction in labour for removing slag, since it mostly drops from above, back into the fire.
(v) Reduction in slag trouble, since no nasty nostril to freeze.

Therefore, having during this Autumn Meeting witnessed the great power of the slogan "Sulphur must go!" I submit that there exists a case for another—"Producer arch must go!"—and I ask the Author (as in order to reduce slag difficulties he already contemplates a modification to the setting) to consider a setting with no producer arch and controlled via a modern compartmented regenerator, in conjunction with the experience which led up to his Paper, and to give us the benefit of his deliberations.

Mr. A. T. GREEN, in reply, wrote: In the first place I thank the members for the reception they have given to this Report. This year's discussion has brought forward a number of interesting features. Mr. Keable's contribution cannot fail to be helpful to us in our investigations of the action of alkali vapours. I have been privileged to see some of the specimens cut from the retort. The deposits of sodium sulphate at the bottom of the combustion flues are very exceptional. Further, the fact that the effect of the alkali is greater in cooler regions of the combustion flues is of considerable importance. I hope to examine the retorts and, also, to make an investigation of the samples taken therefrom in order to make a fuller report to the Institution.

We are greatly indebted to Mr. Edwards for his very important contribution on the behaviour of retorts built of a clay-bonded siliceous material. The gas-tightness of these retorts was a most encouraging feature. Mr. Edwards' tentative conclusion is that the so-called erosion of the floor segments of the lime-bonded silica retorts is, in effect, a spalling phenomenon. This suggests that the degree of resistance of a lime-bonded silica brick to this type of deterioration will depend, in some measure, on the toughness, mechanical strength and tridymite content of the brick. In the study of the flaking of vertical retorts which I carried out some years ago I reached the conclusion that such properties enabled a lime-bonded silica brick to resist, in some measure, this peculiar disintegration. In one of the plant investigations it is interesting to note that the silica material showing the least flaking when compared with four other types was a well-converted brick of high crushing strength and toughness but of comparatively high porosity.

I thank Mr. Threlfall, a member of the Council of the British Refractories Research Association, for his continued encouragement. Mr. Lloyd raises the very important point of research on refractory materials for the utilization side of the Gas Industry. We are hoping that support will be forthcoming to enable such work to be prosecuted with increased intensity. It is certainly a most interesting field.

Mr. F. West is a strong supporter of our work. His lively interest materially helped in the development of the Association. Mr. Toogood's very interesting remarks on his experiences open up a very wide subject. It would appear that there is room for a Paper on the design of horizontal settings.

The Inspection and Maintenance of Gasholders

by
G. M. GILL

A Paper presented to the Midland Association of Gas Engineers and Managers at the Autumn General Meeting in Birmingham on Thursday, Nov. 18.

Experience covering a period of six years in preparing reports of many hundreds of gasholders for an Engineering Insurance Company, after carefully studying the detailed replies by skilled gasholder men to a long schedule of queries, has brought to light a number of facts which can with advantage be discussed at a meeting of Gas Engineers.

Summary of Defects Commonly Observed.

Set out below is a list of defects more or less arranged in the order in which these have been found to be prevalent during the inspections, those most frequent being classed first:

1. Leaks—usually small ones—in the side sheets or crown, and in some cases in the cups or dips.
2. Patches required—usually single bolts.
3. Painting required—in various parts but frequently at wind and water lines.
4. Rollers and axles require lubricating.
5. Cups contain deposits of various kinds and need clearing out.
6. Tree leaves blowing on to holder.
7. No handrails round crown.
8. No ladders.
9. Lifts too much out of level.
10. Rollers require adjustment.
11. Cups or tank short of water.
12. Heavily patched crowns showing signs of considerable wastage.
13. Fatigue of metal and consequent weakness of crowns and lifts due to old age.
14. No anti-freezing arrangements.
15. No non-return valve on steam pipe of anti-freezing apparatus.
16. Corrosion under spiral rails in cases where there is no spiral plate.
17. Badly rusted bolts of horizontal girders.
18. Bad corrosion at junction of ground with steel tank.
19. Loose materials require removal from proximity of masonry tanks.
20. Materials have lodged on landing blocks.
21. Holder requires protection from oxide of iron and sometimes from coke blowing on to holder and accordingly into tank.
22. Tank too much out of level.
23. Weakly constructed tank.
24. Weakly constructed guide framing.

To consider the above in some detail:

1. *Leaks—usually small ones—in the side sheets or crown, and in some cases in the cups or dips.*—In the aggregate a very large number of leaks have been observed and reported, but the vast majority of these have been small. At the same time even a small leak is a somewhat serious loss and in this connection it takes nearly ¾-ton of coal at 12,000 cu.ft. per ton to feed a leak of 1 cu.ft. per hour over a whole year. Gasholder leaks are more prevalent than most gas engineers are aware and it may not be out of place to state that a 1/16 in. diameter hole through a ⅛ in. sheet with a pressure of 6 in. of water will pass 127,000 cu.ft. of gas in twelve months.

2. *Patches required—usually single bolts.*—Patches, often single bolts, are usually required to stop leaks, many of which are disclosed when painting is being done and some during the course of the inspections. There is no question that holders should be regularly and carefully examined for leaks.

3. *Painting required—in various parts but frequently at wind and water lines.*—There are few holders of which it can be said that no painting is required. So often there are bad places at the wind and water lines of tank and cups and dips. On these parts of holders it is very advisable to use a good non-drying paint.

4. *Rollers and Axles require lubricating.*—Rollers and axles are frequently not kept properly lubricated. The best remedy is to instruct one man to look after these and to do the work thoroughly and not less often than once a month.

The grease gun is very effective, provided that the grease nipples are kept clean and free from dirt. By this means, the grease can be forced home properly. This method is applicable to all types of carriages. Stauffer lubricators are also reliable and efficient, but the cups must be filled and screwed down at regular intervals.

The oil bath method is effective for the carriages of spiral holders. Provided that the oil bath is replenished periodically, this method affords continuous lubrication and requires little attention.

5. *Cups contain deposits of various kinds and need clearing out.*—Cups are frequently found to contain deposits of various kinds. These are doubtless due in many cases to the washing down of tree leaves, twigs, soot, chimney dust and sometimes chemical deposits. Some of these deposits cause corrosion, and finally result in heavy expenditure in the replacement of cups and dips. It is curious that the cleaning out of cups is almost invariably neglected. The same deposits are, of course, also found in the tanks.

6. *Tree leaves blowing on to holder.*—The trouble due to tree leaves blowing into holders has already been dealt with under No. 5.

7 and 8. *No handrails round crown. No ladders.*—It is surprising how often handrails and ladders are found to be missing from holders and holder tanks. This applies particularly to older holders, where due, presumably, to misplaced economy, these important parts of the structure were omitted. Except possibly in the case of small single lift holders, ladders and handrails should be added, as otherwise a holder cannot be properly or safely inspected, and any man working on such holders is being made to take an undue risk.

9. *Lifts too much out of level.*—This defect is dealt with under item No. 22.

10. *Rollers require adjustment.*—The re-adjustment of rollers is often necessary. It is one of those matters which require the attention of the expert. It is a bad practice to allow such re-adjustment to be carried out by anyone without the requisite experience. In other words, it is very advisable to call in the holder builders.

11. *Cups or tank short of water.*—There is always the possibility of cups and tanks getting short of water. It is not unusual for leaks to develop and for a holder to blow before it was realized that the cup was leaking. All such possibilities should be listed on an Inspection Schedule, it being made part of the regular routine of some particular man to complete the Schedule at stated intervals.

12. *Heavily patched crowns showing signs of considerable wastage.*—As is generally recognised, the crowns of holders are of particular importance and are more liable to become a weakness than most other parts of a holder. There is always the possibility of a weak crown due to internal or external corrosion or to fatigue of the metal. There is a slight movement on the crown which tends to increase the danger of fatigue. The crown being always above the water level seems more prone to suffer from internal rust should this be a weakness of the holder. In other words, experience would seem to show that a holder crown reaches the end of its life sooner than the sides. Crowns should be critically examined from time to time, and it is reasonable to consider that a crown that has done over 40 years of work is no longer in debt to its owner.

13. *Fatigue of metal and consequent weakness of crowns and lifts due to old age.*—Where weak crowns or sides are known to exist and where excessive fatigue of metal is suspected it is a wise plan to shut down the holder for internal examination, as there is no satisfactory means of arriving at the true state of affairs while the holder remains at work.

14. *No anti-freezing arrangements.*—Quite a large number of gasholders have no protection against frost, and this especially applies to holders in small works where no boilers are in use. Ice in a holder tank can be very destructive and it is doubtful whether even the small village gas-works is justified in dispensing with a boiler which can be used in case of need. As an alternative the holder tank can be oil-filmed, which is a fairly effective substitute.

15. *No non-return valve on steam pipe or anti-freezing apparatus.*—Where anti-freezing arrangements are provided, the necessity of a non-return valve in the steam pipe at a point as close as possible to the steam outlet is some-

times overlooked, with the result that when the steam is shut off there is always the possibility of the water being syphoned out of the cup. To prevent this a non-return valve should always be fitted to the steam pipe, while the throttle valve should preferably be fixed near the steam jet.

16. *Corrosion under spiral rails in cases where there is no spiral plate.*—With spiral guided holders it is sometimes the case that the spiral rails are attached directly to the holder sheets. This is bad design, and it will often be found that rust has formed under the spiral rails close to the lap of the sheets, where there is usually sufficient space to allow of this. There is no practical means of making good this weakness, and as a consequence the life of the sides of the lift is considerably shortened.

17. *Badly rusted bolts of horizontal girders.*—Another part of guide framed holders which should be carefully inspected is the bolts on the horizontal girders. These are very liable to rust, and after many years of use it will sometimes be found that these are in very poor shape. The bolts inside the cast iron columns of old holders are also liable to suffer in the same way.

18. *Bad corrosion at junction of ground with steel tank.*—A weak spot with many steel tanks is the part of the tank at or near to the ground line. Rust is very apt to be found at this point. The ground should be dug away and the tank well cleaned and painted, after which a fillet of asphalt should be placed firmly against the tank sloping downwards from the tank so that water cannot find its way between the tank and the ground. It is better still for no earth to be brought into contact with the tank sides.

19. *Loose materials require removal from proximity of masonry tanks.*—It is surprising how often loose materials are stored close to gasholder tanks. Quite enough foreign matter finds its way into gasholder tanks without running any unnecessary risk of such material as coke, oxide of iron and bricks being inadvertently allowed to fall into the tank.

20. *Materials have lodged on landing blocks.*—Materials of a greatly varied nature are to be found at the bottom of masonry tanks and also to a lesser degree of steel tanks. It is advisable to use a special tool to test whether the landing blocks are clear of obstructions. The tool consists of a long rod with a T-shaped handle at the top and a right-angled end to the rod at the bottom, so constructed that the bottom end can be lowered on to each landing block and turned round to feel whether it is clear.

21. *Holder requires protection from oxide of iron and sometimes from coke blowing on to holder and accordingly into tank.*—Oxide of iron can be particularly harmful, while bricks, iron bars, and similar materials lodging on the landing blocks can cause serious damage. Gasholder tanks should be protected from all such dangers, and this applies to the possibility of purifying material being blown on to the holders, or of a purifying floor draining into a holder tank, in which case the water would speedily become corrosive.

22. *Tank too much out of level.*—Tanks and lifts are frequently out of level. It is always advisable to check their level by measuring the distance between the water level in each cup and the top of the dip, and between the top of the tank and the water in the tank at the northern, eastern, southern, and western points. It is difficult to lay down any rule as to the limits which can be considered satisfactory, as so much depends on the dimensions and design of the holders in question, but should there be any doubt it is very advisable to call in the holder builders.

23. *Weakly constructed tank.*—There was a time many years ago when the steel tanks of gasholders were not constructed of the same strength as is now regular practice. In such cases it is a matter of importance that no wasting should be allowed to take place; and, further, loose earth should not be allowed to be piled against such tanks and so cover up possible defects.

24. *Weakly constructed guide framing.*—Guide framing is sometimes too weak, and as a consequence the holder is not securely held in its framework when rising and falling. In times of high winds there may be too much "whip," presenting unpleasant possibilities. In such cases the framework can usually be strengthened, failing which the height to which the holder can be raised must be strictly limited.

From the above it will be seen that the defects observed are mainly those concerning the maintenance rather than the construction or design of gasholders. This is all to the good, as defects due to the former are much the more easily remedied.

Institution of Gas Engineers' Report.

Since The Institution of Gas Engineers first started issuing reports on gasholders there has been an increasing interest taken in this matter. As a result many gasholders have been examined and necessary repairs carried out. The Institution's gasholder reports have indeed given a fillip to the whole question.

Brief Results of Inspections of 121 Holders belonging to Companies controlled by the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd.—In the Group of Companies which are now controlled by the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd., and with which the Author is closely connected, there are 121 gasholders, and of these 87, or 71·9%, were found to be in very fair condition, only needing in some cases repainting, patching of leaks, and small adjustments. Of the remainder, 16, or 13·22%, were found to have some defect or defects of importance which have necessitated the carrying out of important repairs. Of the balance of 18 holders, 15, or 12·4%, have not yet been inspected, while 3 (2·48%) have been put out of commission as being unfit for further use.

The Author considers that the above summary is fairly representative of what might be found throughout the country generally. The results of these inspections serve to show that the whole question of gasholders needs attention.

Gasholder Foreman.—In the Group of Gas Companies to which reference is made above, it was found advisable to engage a skilled gasholder Foreman Erector with a life-long experience to attend exclusively to gasholders and to carry out repairs and deal with all difficulties which may arise in their working.

New Factories Act.—The Author thinks that most gas engineers will agree that the recently issued requirement of the new Factories Act whereby every holder must be inspected at intervals of two years and a report submitted to the owner by a competent person is reasonable and will in the long run prove of advantage to gas undertakings generally.

Set out below are extracts from the Factories Act, 1937, so far as this relates to gasholders. This Act will come into force on July 1, 1938. Clause 33 of the Act refers specifically to water-sealed gasholders:

"1. Every gasholder shall be of sound construction and shall be properly maintained.
2. Every gasholder shall be thoroughly examined externally by a competent person at least once in every period of two years, and a record containing the prescribed particulars of every such examination shall be entered in or attached to the general register.
3. In the case of a gasholder of which any lift has been in use for more than twenty years, the internal state of the sheeting shall, within two years of the coming into operation of this section and thereafter at least once in every period of ten years, be examined by a competent person by cutting samples from the crown and sides of the holder or by other sufficient means, and all samples so cut and a report on every such examination signed by the person making it shall be kept available for inspection.
4. A record signed by the occupier of the factory or by a responsible official authorized in that behalf showing the date of the construction, as nearly as it can be ascertained, of the oldest life of every gasholder in the factory shall be kept available for inspection.
5. Where there is more than one gasholder in the factory, every gasholder shall be marked in a conspicuous position with a distinguishing number or letter.
6. No gasholder shall be repaired or demolished except under the direct supervision of a person who, by his training and experience and his knowledge of the necessary precautions against risks of explosion and of persons being overcome by gas, is competent to supervise such work.
7. In this section the expression 'gasholder' means a water-sealed gasholder which has a storage capacity of not less than five thousand cubic feet."

Taking Specimens from Gasholder sheeting and testing Thickness of Sheeting.—Quite recently it has become a regular practice to cut specimens from gasholder sheeting. The examination of such specimens gives a very good idea of the conditions of the material and certainly suffices to indicate whether:

(*a*) large specimens should be taken for the purpose of carrying out tensile and other tests,
or
(*b*) an internal examination should be made of the gasholder.

An examination of these specimens shows in many cases that corrosion has taken or is taking place, and it certainly is a useful innovation.

Tools have been devised for the cutting out of specimens from gasholder sheeting. These tools are quite practical and enable the specimens to be cut out without difficulty. Further, convenient means have been devised whereby patches can be placed in position in a matter of a few

seconds. Considerable credit is due to those who have devised these methods. Certainly, there is no need for the use of wooden plugs which have been used too frequently in the past, and indeed in some cases for the stopping up of holes in cups—a highly dangerous practice.

Internal Examination of Holders.—It is at times advisable to examine gasholders internally. At the Stroud Gas-Works, the Oxley Engineering Company was engaged to make an internal inspection of a single lift holder with a capacity of 300,000 cu.ft. The method adopted was as follows:

The holder was first lowered into the tank and grounded on the rest blocks. After flooding both the inlet and outlet pipes, the inlet valve was removed and the live gas main blanked off. The inlet pipe was then pumped clear of water, but the outlet pipe was kept flooded. An air blower was then connected to the inlet pipe and air was blown into the holder with the air cock in the crown open to atmosphere.

The holder was then partially inflated and deflated by closing and opening the air cock, these operations being repeated until it was quite certain that all traces of gas had been removed. As a further precaution the two manholes were removed and the crown was purged with steam.

Several crown sheets were then removed to permit of a raft being lowered on to the tank water. With this in position the men entered the holder and were able to make a thorough examination of the crown sheeting and framework. After this was completed, the sheets were replaced and also one of the manhole covers.

To the other manhole a specially devised air box was fixed. The air box consisted of a steel chamber fitted with two air-tight doors, one in the side and the other in the floor, and each large enough for a man to pass through. This chamber was also fitted with windows, an attachment in the roof for a rope ladder and also a winch which was operated from the outside and to which the life lines for the men were attached.

The opening in the floor of the air box was so constructed that the holes in the flange thereon matched with those in the manhole of the crown to which the box was bolted, a rubber ring being used to make a tight joint. With the air box in position, the men entered the air tight door at the side which was then closed. The door in the crown was then opened, thus giving them access to the inside of the holder.

By means of pre-arranged signals, the order was given to inflate the holder by means of the blower and the holder was raised about 2 ft. at a time, thus enabling the sheeting and internal structure to be thoroughly examined by means of powerful electric torches with which the men were provided. This work was successfully carried out without mishap.

The above method was also adopted by the same firm in making an internal examination of an old gasholder belonging to the Ashton-under-Lyne Gas Company.

Rebuilding a Holder While in Operation.

Excellent repair work can be carried out by welding while holders are in operation, and this is infinitely preferable to the shutting down of holders. It is so much safer to do the work while there is gas under pressure inside the holder. Under such conditions repair work is also considerably cheaper.

An interesting instance of what can be done by welding while a holder is at work can be described with advantage. At the Craven Arms Gas-Works, belonging to the Ludlow Gas Company, there is only one single-lift holder with a capacity of 20,000 cu.ft. This was in a very poor condition and contained no less than 187 patches, the sheeting being obviously seriously weakened.

Accordingly, it was arranged that the entire holder should be enclosed in a new bell which was welded to the existing holder while at work. Before fixing the new sheeting, the old sheets were covered with limpet asbestos, thus efficiently sealing all leaks. The new bell was securely attached by welding to good metal which was found at a point adjacent to the bottom curb. The new sheets were then welded together, leaving a minimum distance between the old sheets and the new. Throughout the entire work the holder continued to supply the district. Originally, it threw a pressure of 4½ in., but with the new outer skin this was increased to 6 in.

Temporary High-Pressure Holders.

To provide against the possibility of a failure of the gas supply while this work was in progress, it was considered prudent to install temporarily two high-pressure air receivers of a size to contain a total of 7,680 cu.ft. at 50 lb. pressure. These receivers, which were bought second hand at a comparatively low price, were connected together and were pumped up by means of a small compressor with a capacity of 2,400 cu.ft. per hour and driven by a 7½-h.p. gas engine. On the outlet of the receivers governors were fitted to reduce the pressure to a few inches for the supply to the district should any mishap occur with the holder under reconstruction. The work on the holder was carried out by the Oxley Engineering Company, Ltd. It is possible that this is the first occasion upon which a holder has been rebuilt in this manner while still at work.

In another recent case it was imperative that additional storage should be provided temporarily to enable a gasholder at Welshpool to be put out of commission. In this case the Gas Company has two holders—one with a capacity of 60,000 cu.ft. and one with a capacity of 11,000 cu.ft. The larger holder, or 84·5% of the total storage, had to be extensively reconstructed, as it was unsafe for further use in its existing condition. The same compressing plant and storage receivers as described above were used, and it was arranged for the compressor to take gas from the smaller holder and to fill the receivers at convenient times, and have these ready for filling the same holder again during the peak-load hours. The compressors drew the gas direct from the crown of the holder to which a short length of flexible metallic tubing was connected to the air cock. This arrangement worked admirably, and it enabled the larger holder to be completely overhauled and again put to work without any serious interference with the town supply.

Remedying Faulty Carriages and Rollers.

Recently there was trouble with the larger of the two holders at Chepstow due to the breaking of two of the bottom carriages and the fact that three of the remaining four bottom carriages were out of line with the tank guides.

This Company is short of holder storage capacity, and it was impossible to throw the larger holder out of commission without endangering the gas supply to the town. It was accordingly decided to repair the damage in a novel manner.

The method adopted was the attachment of carriages and rollers on the top of the tank walls, the tank being of the masonry type. These rollers were made to work in channel guides which were welded to the side of the holder by means of angle brackets at six points midway between the columns. Springs were used to ensure that the rollers made sufficient contact with the channel guides. By the adoption of this method it was possible to keep the holder in commission while this work was being carried out, and then to throw out of use the original bottom rollers and carriages. Since the work was completed, the holder has functioned perfectly.

It is not unusual to find that the plates to which the top carriages are attached have become seriously weakened by corrosion. In some cases the carriages have been so fitted as to permit of corrosion taking place under the carriages which in the past were sometimes designed in such a manner as to prevent these parts being accessible for cleaning and painting. In these cases a very good repair can be made by removing the carriages one by one and welding on new plates to which the carriages can be attached. This work can be done while the holder is at work.

Weak Framework of Column Guided Holders.

On a number of old holders it has been observed that the cast iron columns are not sufficiently supported by horizontal girders. In such cases a lattice girder is attached to the top of the columns, leaving too great a distance according to modern ideas between the lattice girders and the ground line. In such cases an intermediate girder is necessary and has been added subsequently to some of these old holders. This is all the more necessary if, as is sometimes the case, the bolts on the inside of the cast-iron columns have rusted away or been seriously weakened by corrosion.

In a number of cases of single lift holders, the top girders have been found to be of a very light and flimsy construction, giving too much lateral movement.

In such cases the framing has been materially stiffened by coupling the ends of the girders together by means of an angle iron strut bolted to the top flange of each girder independently of the attachment at the columns.

Use of Clay in Faulty Cups.

It is not uncommon to find bad defects in holder cups of such a character that the necessary repairs cannot be carried out until the holder is shut down. This is often impossible, or at least very inconvenient during the winter months. In such cases it is often possible to fill the defective portion of the cup with pug clay, which takes the place of water until the repair can be carried out. It is, however, necessary for someone to be present each time the holder cups to make sure that the clay is in its proper position.

Disposal of Tank Water.

It is sometimes necessary to get rid of holder tank water to enable extensive repairs to be carried out. This is always a troublesome matter.

Recently the Author was concerned with two holders in which the tanks had to be emptied, and in both cases the water was treated in such a way as to permit of its disposal without difficulty. The suitability of a water for gasholder tanks must be considered from two points of view, (*a*) the possible evolution of H_2S therefrom, and (*b*) its tendency to corrode the holder or tank. From both aspects it may be said that town supply water is generally by far the most suitable in that such has low sulphate and chloride contents coupled with a suitable absence of acidity as indicated by a *p*H value of 7 or 8. Such water is practically neutral, inclining slightly to an alkaline reaction. The sulphate content of most town water supplies will have a maximum of 5 grains per gallon, and this precludes the likelihood of serious bacterial growth of H_2S producing organisms. To safeguard definitely against such it is desirable to add, whatever the water, a suitable quantity of zinc oxide—say, 1 cwt. of the colloidal oxide per million gallons at the time of filling the holder tank. In regard to corrodibility, it is essential to ascertain the *p*H value of any water before deciding upon its use. If this value is below 6 the water is unsuitable unless it is treated with alkali in sufficient quantity to neutralize the acidity until a *p*H value of 7 is obtained. Excess of chlorides is to be looked upon with suspicion. These will never be excessive in a town supply, but may readily be in the water of a tidal river. Not more than 50 grains of chlorides per gallon is allowable under any circumstances. Any circulatory system for holder water, if it be brought into contact with the air, should be avoided, as such inevitably increases the oxygen content and adds to the chances of corrosion of the holder sheeting. In this connection it is always advisable for the oxygen content of the gas to be not more than 0·5%.

Turning to the treatment of holder water prior to its disposal in a stream, river, or sewer, the chief object is the elimination of the characteristic smell. The cyanide content is not usually sufficient to make such water lethal, but the penetrating odour makes it suspect to everyone. The addition of caustic lime at the rate of 14 lb. per 1,000 gallons has been found to reduce the smell very considerably and has rendered the water suitable for disposal to the sewer or river after dilution with other water and aeration by contact with the air.

Weighting Gasholders.

In a considerable number of cases it has been found desirable to weight gasholders provided that examination showed that the holders were strong enough to support the weighting. In nearly all cases weights have been placed around the top curb of the crown. These weights are made of concrete, and incorporated in these weights is scrap metal to increase the weight of each block to 56 lb. The weights measure 12 in., tapering to 11¼ in., and 12 in. wide by 6 in. thick. On the underside two projections are formed so that support of the holder is limited to two surfaces of 12 in. by 1 in., so permitting rain to flow freely from the crown underneath the weights. It is usual to paint the weights the same colour as the holder, so rendering their presence almost unnoticeable.

These weights are made at the Cheltenham Gas-Works, where concrete blockmaking has been carried out on quite a large scale for many years. It is important that Gas Engineers should satisfy themselves before weighting holders that the holder is sufficiently strong to land on the rest blocks with the weights in position. Holders can obviously carry far more weight when inflated than when resting on the landing blocks. It must be borne in mind that a holder, except when inflated, is not constructed to support any excessive weight on the crown.

Discussion.

Opening the discussion, the PRESIDENT (Mr. H. Davies, of Chesterfield) observed that he thought the object of Mr. Gill's Paper was that they should consider his remarks in the light of the requirements of the new Factory Act, which provided for gasholders being classified as factories. Therefore, all holders of a capacity of more than 500,000 cu.ft. were concerned, and it was essential for every gas engineer to see that his holders were regularly examined and maintained in proper condition. One cause of corrosion, went on Mr. Davies, was the state of the water in which the holders were immersed, and it would pay them to take periodical samples of this water. Many people thought that the tanks could be filled with any water, but it would be found that rain water contained many properties of a very corrosive nature. His own method was to test periodically for acidity or alkalinity and to counteract the former with ordinary common soda. But this would not solve the problem in every case; the water in the tank had a good deal to do with corrosive action in many holders. His own experience of gasholders built thirty to thirty-five years ago showed that they were not of the same type of metal as those built prior to that date. As regards painting, he considered that more attention should be given to this than had been the practice in the past. Even the manufacturers did not pay sufficient attention to this. Many insurance companies were now offering terms for inspection and insurance of gasholders, and while the Act did not call for insurance the matter should be looked into, for there were many points to be considered. They did not experience a great deal of mechanical breakdown in gasholders, though it was a risk they must bear in mind—and such risks could be covered by insurance. Fire and lightning dangers could usually be covered by insurance, but damage from air-raids was not always covered. He thought, therefore, that the time might be ripe for considering the insurance of gasholders. There were a number of good firms in this country who could carry out examinations of gasholders, but whether this in itself would fill the bill Mr. Davies was not prepared to say. Many insurance companies were quoting inordinate terms for this class of work, but when they had more experience of the work involved it might be that the rates would be reduced. The cotton interests in Manchester had formed an association for this purpose, and he suggested that gas undertakings might well set up a similar scheme for gasholder inspection.

Importance of Handrails.

Mr. G. C. PEARSON (Birmingham) said he thought handrails should not be omitted on crowns or dips, and on high gasholder frames they should be on both sides on the top girder. In many cases the crowns were very steep and it was very necessary to have handrails. He thought they should be in three rows 8 in., 2 ft., and 3 ft. 6 in. As to lifts, he pointed out that with inner lifts of medium or shallow depth it was difficult to keep them level by guide roller adjustment or the packing of rest blocks. Adjustment of carriage rollers should take place actually on the carriage cheeks and should be quite positive and not depend on slotted holes but fitted with adjustment screws. Holders were frequently fitted with carriages that moved on the crown, thus including a base that tended towards corrosion.

Where cups or tanks ran short of water he recommended a hydraulic supply or pumps delivering to the gasholder side-sheets for replacing the water. As to heavily patched crowns showing signs of considerable wastage he pointed out that deterioration took place at internal seams where deposit collected if the lap was laid for external water diversion. A further bad fault in some old crowns, and the reason for extensive patching, was the fixing of the crown sheeting at the centre to the crown framing. This caused a bellying of the sheets from the centre and brought undue stress on the inner rows of sheets.

Regarding no non-return valve on the steam pipe of anti-freezing apparatus, he had seen that overcome by putting a small hole in the bend at the top of the syphon or the inclusion of an atmospheric spring release valve.

As to corrosion under spiral rails in cases where there was no spiral plate he said corrosion took place at the laps of the sheets and could be prevented by means of taper liners or thinning sheets. With badly rusted bolts of horizontal girders the bolts should be removed at intervals of twelve months for inspection. A more serious fault was that of leaving cavities at junctions in lattice work, especially, for instance, where a member was formed of double angles back to back. The angles should be definitely divided by packings so that this space did not form corrosion spots.

With reference to bad corrosion at the junction of the ground with the steel tank he urged that the surrounding ground at the base of tanks should be permanently trenched and drained, and again all loose materials should be removed from the proximity of masonry tanks, as well as material that might lodge on landing blocks. He pointed out that a holder required protection from oxide of iron and sometimes from coke that might blow on to the holder and then into the tank. He had found that sludge deposit and loose material up to the size of half-inch bricks could be removed by a non-chokable 6-in. pump. Tanks in a dirty vicinity should be cleared every ten years.

It might interest them to know that in 1926 they had a tank of 220 diameter and 50 ft. deep at Windsor Street which started leaking at the rate of 12 in. a day, causing complaints from the surrounding district of contamination of supplies. Divers were put to work on the tank and they found various cracks and repaired them under water as best they could. That brought the leakage down to 3½ in., but within six months it was back to 12 in. Then they tried to overcome the trouble by the use of cement grout under pressure. A boring was made 3 in. diameter and 70 ft. deep at the side of the tank, lined 30 ft. with 3-in. pipe. Pressure was placed on this boring and air blew into the holder tank forming a spray a distance of 200 ft. round the tank. 750 two cwt. bags were pumped into this boring without result, and a second bore was made close by, and 12 or 14 bags in this position reduced the leakage to 3½ in. per day. Eventually over a thousand tons was used in the vicinity of the holder and when they finished the leakage was down to three-eighths of an inch per day and now was reduced to three-sixteenths.

Need for Competent Inspectors.

Mr. R. J. MILBOURNE remarked that the schedule of particulars issued by The Institution of Gas Engineers gave one the impression that it was based more upon guide framed than

spirally guided holders, while waterless holders did not appear to be mentioned in the new Factory Act at all and were apparently free from obligatory inspections for the time being. Competent inspectors, or men of special training and experience only, should be employed for this work, and it would be necessary to satisfy the Home Office, in case of accident, as to the competence of the inspector and author of the report. Inspections might be placed in three classes—namely, (1) External inspection with holder in use; (2) External and internal inspection, which involved clearing out the last traces of gas and filling the holder with air; and (3) Internal inspection with water removed from the tank. Internal examination required special apparatus for the purging of the holder and a large amount of tackle.

Continuing, Mr. Milbourne said that the insurance of gasholders was optional, though most of the policies he had seen did not give sufficient cover, as they excluded fire, lightning, riot, war risks, wear and tear, gradually developing defects, explosion, and loss sustained through stoppage of work, or increased cost of production resulting from accidents. Also the first £10 to £30 of any claim had to be borne by the gas undertaking. There seemed to be an absence of reference to the importance of levels when holders were spirally-guided. If the tank was out of level the lifts might hang up on one side on the carriages instead of landing on the rest blocks in the tank, causing very undesirable stresses on the tank and lifts. Then again, the level of the tank should be carefully taken in the case of standard guided gasholders, as any inequality in the levels of the rest blocks would throw undue stresses on the sheeting of any of the lifts when landed. The inspection of holders should include the tank. Any faults of design or construction should be noted, and prompt rectification of any disclosed defect should be an invariable rule.

It might be taken, went on Mr. Milbourne, that the approximate number of holders owned by gas undertakings in England and Wales amounted to a total of 3,800. There was little doubt that a large number of holders were in good working condition, especially those erected during, say, the last fifteen to twenty years; and, therefore, to comply with the Act, it seemed that the inspection of many of these structures would be of a somewhat cursory character, owing to the careful attention which had been given to them. The Gasholder Committee of the Institution had repeatedly directed attention to the necessity for the adequate inspection and maintenance of gasholders and the keeping of a systematic record of these. It was to be regretted that they were to cease their work as a separate entity, as their assistance and advice in the future would be extremely welcome and useful to the members of the Institution and the Gas Industry. According to the present Factory Act, cranes, boilers, &c., came under the Factory and Workshop Act, 1901-1929, and reports on these had to be made out on printed forms prepared by the Secretary of State. It seemed to Mr. Milbourne that in due time a definite prescribed form would be issued by the Government Department for the inspection of gasholders—and when this took place it might modify the scheme of inspection they now had in mind.

Mr. Milbourne went on to say that the weighting of gasholders was a thing which must be done with caution. Stresses were important and might cause distortion of the top curb, which might bring about the collapse of the holder. It was a great mistake, he said, to weld gasholder crown sheets on one side only, for the underneath lap would be liable to open out and assist corrosion. If one did weld it was imperative to weld both the outside and inside of the lap. As regards cutting discs for inspection purposes, he would like to utter a word of warning; he had found on many occasions that a sheet was perfect in one spot, and yet 6 in. away it was very badly corroded. Thus a disc of 3 in. diameter might indicate an absolutely perfect sheet, whereas it might be pitted to half its depth a few inches away. Therefore, while these discs could be very useful, they must not be taken as conclusive evidence that the inside of the holder was free from corrosion.

Filling Tank from River.

Mr. H. Chamberlain (Sheffield) said that they wanted more guidance as to the points from which they should cut the sample discs; also they should have some method of procedure for safeguarding men at work inside a holder tank. He endorsed what Mr. Pearson had said in regard to the provision of handrails, and stressed the importance of the utmost care in the design of these rails around the top of the tank and each lift. As regards holder water, they had at Sheffield a small river adjacent to the works from which they filled their tanks. This water was sampled continuously throughout the filling period, while samples were also taken out of the tank. The water was found to be quite suitable; but as an additional precaution zinc oxide was sprayed over the whole surface of the tank before the holder was filled with gas. Mr. Chamberlain expressed the opinion that they should take samples of the tank water periodically to ensure that it was of the right quality.

Mr. J. P. McCrae (Derby) asked who was competent, within the meaning of the Act, to examine gasholders. The average gas engineer treated his holders as ordinary pieces of plant, and if he was not ensuring the necessary inspection he was not carrying out his job. Was the inspector competent to decide whether the tensile strength of a holder was adequate?

Mr. F. C. Briggs (Dudley) said that the makers should so design their holders that there were no potential points of corrosion which were not easily accessible. From the way some holders were designed it might be imagined that the draughtsmen did not know of the existence of corrosion at all. There were many points on a holder which it was impossible to paint. He enquired whether Mr. Gill had any experience of the use of non-drying paints on the inside of new holders. One could not get inside holders to inspect them as much as one would like, and he thought such paint might be a good protection against corrosion inside the holder. Mr. Briggs also asked if there was any cure for the H_2S bogey in old tank water. The addition of chlorine was a very dangerous practice.

Mr. G. Dixon (Nottingham), referring to the Chepstow holder mentioned by Mr. Gill, asked how far down the channel guides went; he took it there was some form of stop. He presumed there was an annular space between the old sheets and the new which was filled with limpet asbestos in the case of the Craven Arms holder. What would be the effect of gas leaking into the annular space and condensing? Would this not have the effect of increasing the weight of the holder and also providing a further source of corrosion? Mr. Dixon also wondered whether the expense involved in regard to the Stroud holder was justified. The disc-cutting tool did not provide a representative sample of the whole section of a holder. Furthermore, who examined the discs? He wished they could have some idea of the reasonable limits in respect to the levels of holders. His own experience was that holders built 50 years ago were generally equal to, or better than, those being built at the present time.

Mr. W. G. S. Cranmer (Willenhall) related some of his own experiences in regard to gasholders, observing that these pieces of plant continued to go up and down without giving any great amount of trouble for very considerable periods, and, consequently, very little attention was apt to be paid to them. A few years ago it was unusual to find any attention being paid to the lubrication of the rollers. He had occasion to empty a holder tank, and the condition of the sheets was remarkable; in many cases the original paint marks were still visible, and there was not the slightest trace of corrosion, while the spindles and rails on the outer lift showed no wear, the water having evidently acted as a lubricant. If the gas was all it should be there should be no corrosion; if there were no oxygen, cyanides, or H_2S present in a clean coal gas what source of corrosion could there be? The holder to which he had referred was erected in 1893, and when it was opened up six years ago the girders were in excellent condition, while in another holder they had to renew two rows of girders which were replaced by R.S. joists; the latter offered very little opportunity for corrosion to take place.

The Gasholder Committee.

Mr. H. C. Smith (President of The Institution of Gas Engineers), to whom Mr. Davies extended a cordial welcome, said he did not think Mr. Milbourne need have any fears about the demise of the Institution Gasholder Committee. This body had been merged in another Committee dealing with the question of Safety on Gas-Works, but all the members of the original Gasholder Committee were on the new Committee, which was ready and anxious to deal with matters with which the old Committee used to deal. Mr. Smith pointed out that it was difficult to find people to give their time to serving on these various Committees. It had been suggested that the Home Office would make more stringent regulations in regard to the examination of gasholders. Without suggesting that the existing regulations necessarily represented finality, he said that so long as gas engineers would honestly carry out the provisions set out in The Institution of Gas Engineers recommendations, whatever new regulations had to be made would be made in consultation with the Institution. Had engineers followed the lead given by the Institution they would not have had these regulations thrust upon them. And unless engineers did carry out these regulations in the future they might well be faced with much more stringent ones. It might be imagined that one could repair a holder full of gas by welding. The Factory Act would have prevented them from so doing; but representations were made, with the result that now, provided there was no danger, it might be possible to repair holders by welding. But they could not do so without first obtaining the necessary sanction. If Mr. Gill's Paper had the effect of making engineers carry out the regulations it would have done a great deal of good.

Mr. T. F. E. Rhead (Birmingham) called attention to the purging of gasholders and referred members to recent Papers by Mr. Birks and Mr. Bengough, as well as the A.G.A. code, in this connection.

Replying to the discussion, Mr. Gill said it was clear that Mr. Pearson had given a great deal of attention to the question of holders—which was what a true gas engineer ought to do. Mr. Gill agreed that when steel took the place of iron about 35 years ago it was not like the steel of to-day; there was something wrong with it, and extensive repairs had to be carried out. He also endorsed the view that the valuable work of the Institution Gasholder Committee should be continued, and he was very glad to hear what Mr. H. C. Smith had said in this regard. With reference to the cutting of discs, it would be found that when they examined a series from one holder it did tell them a great deal more than might be expected. Such specimens would be very useful to those who took them regularly and studied them. Mr. Gill had been exercised about the safety of men who carried out internal examinations; he also felt strongly on the subject of handrails, and there were many holders on which they should be fitted.

The meeting closed with a hearty vote of thanks to Mr. Gill for his interesting and valuable Paper, which was accorded on the proposition of the President.

Prepayment Meter Administration and Collection

by
R. AYNSLEY,
of South Shields

A Paper read before a meeting of the North of England Gas Managers' Association (Auxiliary Section) held at Newcastle-upon-Tyne on Friday, Nov. 26.

I think this is the first time a Paper dealing with the administrative side of a gas undertaking has been given before the Auxiliary Section of this Association, and it has been a matter of some concern to me to present this Address in such a form as may be interesting to all members.

During my 24 years' connection with the South Shields Gas Company, the Prepayment Department, in common with that of practically every undertaking, has grown with rapid strides, particularly in the last eleven years, the consumers having increased by nearly 10,000 to the present total of 30,700. This has necessitated many changes in administration, and we consider that the system which has been evolved is eminently suitable and applicable to an undertaking similar or smaller in size to this Company. I trust, therefore, some points will reveal themselves which may be of interest and possibly of assistance.

The popularity of the slot meter is undoubtedly due to the average thrifty housewife's dislike, and sometimes fear, of having a quarterly account to meet, and the desire to regulate her gas requirements according to the size of the family purse. She prefers to pay as she goes along, and particularly is this so with the working-class household. But with the building of so many cheaper modern homes, this popularity is extending to the middle-class consumer who is buying his own house, and feels that the fewer the bills to meet at the end of the quarter, the less will be his worries.

If industrial and commercial consumption is becoming the backbone of the Gas Industry, then slot consumers, from their very numbers, can be said to be the life blood of an undertaking, and every effort should be made to retain the goodwill and patronage of this large and steadily increasing class of consumer by efficient and ungrudging service.

The use of up-to-date advertising with its modern appeal has done much to keep the uses and advantages of gas well to the forefront of the public mind, but most of its value is lost unless there is the necessary efficient distribution and service organization to back it up. The poorer class of prepayment consumer should be given the same prompt, careful, and obliging attention which would be accorded the well-to-do consumer in a large house.

In days happily now past I have felt that slot users were regarded more or less as the " Cinderellas " among the consumers; but the fact remains that at South Shields at least the Prepayment Department is the largest revenue producing department in the Company, and as such is entitled to, and is now receiving, a good deal of care and thought in regard to the problem of service and maintenance.

Personnel.

The average gas undertaking has usually a great preponderance of prepayment consumers, and where there is the opportunity for personal contact with so large a number of householders, it is a matter of great importance that the selection of collectors be undertaken with more than usual care. To a far-seeing employer, a high standard of integrity and the ability to count a certain amount of copper correctly should not be the only qualifications required of the collectors, if he is to make the fullest use of his potentialities as an intermediary between the company and the consumer.

In my Company, it is the rule to engage " clerk-collectors " who, apart from their essential duty as collectors, can be called upon to undertake other work on the district or in the office in an emergency; and it has been found that a higher standard of efficiency has been obtained.

Various canvasses have been carried out by the prepayment collectors with very satisfactory results. It has been found from experience that cookers and other apparatus are allowed to fall into disuse and consumption for lighting is lost because of the apathy or procrastination on the part of consumers in reporting their faulty condition. By means of enquiries from house to house during the course of the survey, these faults have been elicited, and fitters and/or lighting maintenance attendants have been despatched to remedy the complaints to the mutual satisfaction of the consumer and the Company.

It is not always practicable to utilize the collectors in this manner, but on the occasions when canvasses have been made, their value has been proven by the number of orders received for various apparatus and lighting maintenance goods.

On other occasions, lists have been prepared showing consumers who had either stopped using gas, or were showing small consumptions. Collectors were sent to call upon them, and here again the results of the canvasses were very gratifying and, so far as gas lighting is concerned, must prove a valuable means of combating the present tendency to go over to electricity. It is worthy of being more intensively employed.

A system of bonus for meters collected over a certain minimum per day has been in operation many years, and this has proved a great incentive to keenness and even friendly competition, the collectors realizing that the greater the effort put forth in their work, the greater the effect on the amount of bonus they will draw at the end of the quarter.

The scale provides for a bonus of 1d. for every meter collected over a minimum of 55 calls per day for March and June quarters, and over 70 calls per day for September and December quarters.

Lighting Maintenance Scheme.

A scheme of lighting and burner maintenance has been in operation since 1927, whereby burners, globes, mantles, &c., are supplied to consumers, the cost either being paid at the time of fixing or retained from subsequent rebates. About 43,000 articles are thus issued each year, and a total of 432,000 articles have been distributed since the inauguration of the scheme.

Usually six lighting maintenance attendants are employed, and these make approximately 63,500 calls during the year. In these days of keen electrical competition this has undoubtedly been the means of retaining much of the lighting load which would otherwise have been lost.

The attendants carry with them a supply of burners, mantles, and globes, and their visits have proved very popular with the poorer class of consumer, who appreciate the privilege of obtaining goods without the necessity of paying cash down. They not only supply burners, &c., where required, but also adjust existing lights on request, and the consumer's appreciation of this service is shown by the high percentage of calls where adjustments are asked for.

There is a growing demand for bowls, and these are supplied in connection with the scheme. They are attractive, and make the light comparable in appearance to electric lighting. Anything of this nature should be exploited to the fullest extent.

The table below gives particulars of the articles supplied and the numbers issued since the commencement of the scheme:

—	Average Number of Articles Issued per Annum.	Total Issued from July, 1927, to September, 1937.
Burners	5,888	59,535
Mantles	20,651	211,020
Nozzles	380	3,901
Fancy globes	8,412	85,748
Opal and clear globes	1,907	19,069
Clear globes	2,990	29,987
Gas adjusters	45	467
Air sleeves	..	2
Pendant adapters	1,791	17,940
Bracket arms	462	4,648
Globe set screws	15	159
	42,541	432,476

Quarterly Survey and Progressive Survey.

In reviewing the relative merits of "Quarterly Survey" and "Progressive Survey," the class of consumer and the districts to be covered must of necessity be considered; but there is no doubt in the writer's mind that "Quarterly Survey," properly organized and supervised, has many advantages over "Progressive Survey" in regard to the keeping down of collection costs, the ease in compiling accurate comparative statistics and the alacrity with which quarterly balancing can be accomplished.

The area covered by the South Shields Gas Company comprises three town districts and five outlying rural districts, and the quarterly survey is so regulated that the 30,000 prepayment meters are collected once in every quarter, commencing on the first day of the quarter and finishing on the last day of that period.

By carefully controlling the speed of the collection, accurate comparative results can be obtained from day to day, the period of consumption of each meter and each district being the same within narrow limits. Increases or decreases of consumption in any particular district can be readily ascertained, and where any appreciable decrease is shown, the cause of such decrease can be sought and, if possible, remedied without delay. In addition, collection costs are reduced to a minimum, as each district is visited once only in each quarter—with the exception of removals and special calls. This system has been in operation since 1908, and has been found to work smoothly and evenly during the whole of that period.

It is the procedure of some undertakings to practice what may be termed "Progressive Survey"—that is, the collectors are allowed to survey the whole of the area in as short a time as possible, and then immediately commence a second and sometimes a third survey of the district in the same quarter.

It will be seen that instead of the collectors clearing, say, 30,000 meters in any one quarter, the number might easily become 60,000, or even 90,000.

The number of collectors necessary to make such an increased number of collections must necessarily be many more than in the case of an undertaking which surveys only once in a quarter, and a greatly enlarged salaries list must result. In addition, especially where there are many not readily accessible outlying districts, travelling expenses are multiplied two and sometimes three times, together with the corresponding loss of time taken in travelling to and from work.

The difference in time taken by an experienced collector to count, say, two pounds of silver or copper as against one pound is, after all, small. The greatest factor is the time taken in getting to the districts to be surveyed and in going from house to house; this time factor can assume serious proportions if the houses concerned are isolated or are of the detached villa type with garden paths.

The money collected from prepayment meters forms a very convenient and steadily flowing source of ready cash with which to meet the various weekly and monthly commitments of an undertaking; but if the collection is erratic and uncontrolled it is extremely probable that one quarter may be impoverished at the expense of another, and certainly accurate comparisons are impossible.

It may be argued where there are a number of comparatively heavy consumers the meters would get too full by the end of the quarter. To overcome this, we have in use a "Heavy Meter List," whereon all meters with an abnormal consumption are tabulated, together with date of last clearance, and they are cleared fortnightly, monthly, or bi-quarterly, according to the amount of gas consumed. This duty devolves on the two motorist emergency collectors, who work in a number of these heavy meters with their daily work, thus relieving the regular collectors when they clear the meters on the usual quarterly survey.

Book-keeping and Records.

In this age of modern card systems and mechanical devices, many clever—and sometimes expensive—methods of keeping consumers' records have been evolved. To the large undertaking with a great number of consumers, where the keeping of records by any other means would be too unwieldy and cumbersome, these modern systems must indeed prove a boon and a necessity; but although many of these methods have been examined from time to time, we at South Shields have not thought it expedient or necessary, either from a point of speed or accessibility, to change from the system now in operation. Balancing can be accomplished in a minimum of time and the consumer's record can be quickly and easily seen.

The system in use comprises the following:

(*a*) Collecting card.
(*b*) Collectors' cash books.
(*c*) Deferred cash book.
(*d*) 6 Loose leaf consumers' ledgers.
(*e*) Abstract summary book.

The essential records are contained in the ledger on permanent name leaves, on which are shown:

1. Name and address.
2. Size and number of meter.
3. Particulars of apparatus and fittings.

The records are kept up to date from particulars of fixings and disconnections supplied by the Distribution Department on special sheets. These entries are posted daily to the respective consumer's record, so that the composition of an installation at any particular address can be seen at a glance.

The collecting card shows:

1. Ledger folio.
2. Name and address.
3. Date of survey.
4. Index of meter.
5. Cash collected from the box.
6. Amount due the Company.
7. Shorts and overs.
8. Amount of rebate paid.

In connection with the lighting maintenance scheme, gummed slips are also attached to the cards where goods have been supplied, showing the application number, date, and amount to be retained out of rebate.

Particulars of accounts for apparatus rents, &c., in arrears are marked on the cards, and this is also retained from rebates. To ensure that arrears are marked up to date, the cards due for collection on the subsequent day are passed in turn to the respective ordinary rental clerk, the hire-purchase clerk, and the fittings clerk, who see that the amounts are brought up to date, and new arrears added.

The collectors' cash books are arranged with a folio column, six cash columns plainly headed 1, 2, 3, 4, 5, and 6 ledgers, and a lighting maintenance cash column, and the collectors enter up their work each night on their return to the office. The total cash shown at the end of each day's work is checked with the cash slip handed to the cashier, the total of the lighting maintenance column being taken off by the clerk in charge of those accounts. A cash summary is prepared at the end of the quarter and, subject to adjustment of entries transferred to the deferred cash book, shows the amount of cash posted to the relative ledgers.

The deferred cash book is similar to the collectors' cash book inasmuch as it has 6 ledger columns, but with the addition of an index column and a tariff column. The ledgers, which are described later, contain approximately 5,000 accounts each, and as the quarterly survey proceeds, each ledger is closed off and balanced in turn.

Cash which may be collected after a ledger is closed—where a consumer has removed or a meter becomes full, or for any reason is cleared more than once during the quarter—is transferred to the appropriate ledger column in the deferred cash book, and subsequently posted to the ensuing quarter.

The ledgers consist of a permanent name leaf, described previously, and a larger fly leaf containing columns for March, June, September, and December quarters, and having an index column, columns for consumption under the four tariffs, a therm column, folio column, and a cash column.

Cash posting is done by means of the duplicate posting slip system, one series of slips being allotted to each cash book, and these, in conjunction with the comptmeter, enable 500 to 600 cash postings to be balanced daily.

The slip itself consists of a strip of paper the width of the ledger cash column and ruled accordingly, the reverse side being treated with a copying medium. The actual posting is made on the slip itself, the copy being transferred to the respective account. The slips are passed to the comptometer operator, and cast up, and if the posting has been carried out correctly, the total of the slip should be the same as that shown in the particular cash book to which it refers.

In this way, the ledgers can be balanced within a very short period of the last posting being made.

Motor Assistance.

Up to the year 1926, the method of collecting and disposing of copper was for the collectors to put up the copper collected in 5s. tubes, and when a sufficient load was obtained, they then proceeded to the nearest branch of the Company's bank and there parcelled same into £5 parcels, receiving in exchange notes to the value of the copper deposited.

Allowing an average of ten minutes' walking time to and from the bank on two occasions per day (mid-morning and mid-afternoon) and 5 minutes only in the bank parcelling and paying over copper, and allowing fifteen minutes at the dinner hour (walking time one way only), it will

be seen that 65 minutes per man were wasted, making a total of over 7½ hours per day for the seven regular collectors employed, and as the actual time spent in clearing meters was five hours per man per day, this is equal to 1½ collectors.

About this time, the number of consumers had been steadily increasing, and it was foreseen that unless some assistance was given to the existing collecting staff, extra men would shortly have to be engaged.

It was decided to purchase a Rudge Special motor cycle with a modified side-car attachment, consisting of a box with compartments and specially constructed trays of suitable size to receive the 5s. tubes of copper. One of the collectors was detailed to ride the combination, and it was his duty to meet the collectors at stated times and places which were pre-arranged each morning, three times during the day and at times which approximated their usual journeys to the bank.

The bulk copper was then brought to the office and parcelled up by the inside staff. The intervals between meeting the collectors was utilized by the motor cyclist in attending to removals and special calls which had formerly been collected by the regular collectors in turn.

In August, 1928, an accident to the motor cycle made it necessary to purchase another machine, and a similar model was put into commission. Excellent service was obtained from this second motor cycle, it having only been put out of commission in April of this year, after 8½ years' service and covering an estimated mileage of 115,000, and having carried about 670 tons of copper, or approximately £300,000 sterling.

The following statistics will give some idea of the valuable assistance rendered by the motor cycle combination up to the year 1934 (in which year additional motor vehicle assistance was brought into use, described later). I have selected March quarters for the purpose of these comparisons, as being the heaviest quarter of the year, and when the help of the motor vehicle is of greatest assistance:

Average number of meters (excluding removals, &c.), surveyed per man for :—

March quarter, 1934	4,136
,, 1933	4,740
,, 1932	4,409
,, 1931	4,558
,, 1930	4,577

Average for five years with motor vehicle = 4,484 per March quarter

March quarter, 1926	2,777
,, 1925	2,535
,, 1924	2,166
,, 1923	2,573
,, 1922	2,555

Average for five years without motor vehicle = 2,521 ,, ,, ,,

Increase per man per quarter . 1,963 = 77·86%

The following table shows the relative *total* number of meters surveyed for March quarters 1934 and 1926—the latter being before the use of motor vehicle assistance:

—	Total Calls for Seven Regular Collectors.	Removals and Special Calls.	Total Calls.
March quarter, 1934	28,951	3,782	32,733
,, ,, 1926	19,433	2,039	21,472
Increased calls	9,518	1,743	11,261
	48·98%	85·48%	52·44%

It will be seen that 9,518 more meters were surveyed during March quarter 1934 than in 1926, and taking the then average of 2,521 calls per man for March quarters, it is reasonable to assume that 3·77 more men would have been required to clear the additional 9,518 meters. Removals and special calls having increased by 85% in that period, it would have taken 85% of an additional man's time to deal with the extra "emergency" calls.

By the end of 1933, the number of consumers had increased to over 30,000, and with the advent of the numerous housing schemes, which are for the most part in outlying districts, and also the large number of meters which had been fixed in better-class streets and outlying parishes, hitherto almost entirely served by quarterly meters, the meeting of the collectors by motor cycle was becoming increasingly complicated and time taking, and it was decided some more reliable and dependable means of collecting and carrying the copper was required.

Specifications of various commercial vans were obtained, and in May, 1934, a Morris 5-cwt. light van was purchased as being the most adaptable. A strong wooden box of suitable size with a lid which could be securely locked, was bolted to the floor of the van, and no further adaptation was necessary. The trays which had been used with the motor cycle were kept in use.

The van was put into commission in June, 1934, and has been particularly trouble free. The motor cyclist was given charge of the van, and as the motor cycle was still in fairly good order, it was retained as an auxiliary machine in case of breakdown of the van. This has not yet been necessary, although the van has been in use for over three years.

The motor cycle was used up till April of this year by an emergency collector who is engaged to cope with the greatly increased number of removals and special clearances, and this again proved a great saving of time as against the pedal cycle previously in use. He and the van driver now efficiently deal with these calls, the emergency collector returning to the office three times during the day to receive and parcel the copper brought in by the other driver.

The following are particulars and running costs of the vehicles in use from October, 1926, to September, 1937, and will be some guide as to the cost of motor assistance over a period of eleven years:

	£ s. d.	£ s. d.
1st Motor Cycle Combination (October, 1926, to July, 1928)—		
Cost of motor cycle	61 19 0	
,, repairs and renewals	33 1 3	
,, petrol and oil	25 5 0	
,, tax and insurance	18 4 0	
		138 9 3
2nd Motor Cycle Combination (August, 1928, to April, 1937)—		
Cost of motor cycle	69 7 8	
,, repairs and renewals	149 11 9	
,, petrol and oil	145 3 11	
,, tax and insurance	77 11 7	
		441 14 11
Morris 5 Cwt. Van (June, 1934, to September, 1937—still in commission)—		
Cost of van	108 1 3	
,, repairs and renewals	32 10 4	
,, petrol and oil	63 15 3	
,, tax and insurance	65 17 7	
		270 4 5
Total cost of motor assistance over 11 years		£850 8 7
Total average cost per year =		£77 6 3
,, ,, ,, ,, week =		£1 9 9

The motor cycle used an average of about 5 gallons of petrol and 1 pint of oil per week, and the Morris van approximately 6 gallons of petrol and 1 pint of oil per week. The cost of repairs only over 11 years average 7s. 6d. per week; petrol and oil, 8s. 2d.; and tax and insurance, 8s. 4d.

Accessibility of Meters.

It would be thought that due consideration would always be given to the position in which a meter—particularly a prepayment meter—is to be fixed, not only with a view to ease of access by the consumer, but more especially by the collector. I have, however, heard of meters being fixed in such thoughtless and out-of-the-way places as to become a nuisance to both collector and consumer.

In new property, perhaps more than in old, where rooms and cupboards are empty, and the consumer has not had the opportunity to collect the heterogeneous odds and ends which seem to accumulate after long residence in a house, it may perhaps be difficult to visualize that such and such a position may not turn out to be as convenient as at first appeared; but a little consideration by the official concerned would soon discover the most convenient site.

On one estate the meters were fixed in the drawing-room, in a small cupboard built into the only long wall on which it was possible to place, say, a sideboard or piano, with the result that the collector, sometimes with the aid of the consumer, had to move the piece of furniture to get at the meter, with a consequent loss of time—and possibly of temper. The consumer was also put to the same trouble to insert money in the meter, and you can imagine there would be times, when the man of the house was not available to do the furniture moving, the gas would not be used at all.

Indoor coalhouses and lavatories have also been selected as sites for meters, and these are patently unsuitable, and where cupboards are built under stairs it is well to remember that the nearer the meter is to the door, the less likelihood there is of rubbish being stacked in front of it, so that the collector does not have to waste what are to him valuable minutes, waiting until lumber is cleared away to enable him to reach the meter.

Builders sometimes stipulate that the meter is to be fixed in a certain place; but where experience has proved such a position to be unsuitable, it should not be difficult to point this out, and suggest a more convenient place. A jealous eye is always being kept on fixing costs, but it would be folly if, for the extra charge of a few feet of piping, the consumer may be inconvenienced and possibly antagonized.

I have quoted these extreme, but nevertheless authentic, cases to emphasize the necessity of selecting the most

suitable and convenient position for slot meters, so that the consumer may be occasioned as little inconvenience as possible in putting in his or her coppers, and the collector is able quickly and easily to read and clear the meter.

In conclusion, I hope this Paper will be of some interest, assistance, and partial guidance to the small undertakings who may be at the beginning of an increasing demand for prepayment installations. I would also like to add that much good to the Industry can be accomplished by all those interested in giving freely their advice and assistance whenever or wherever the occasion presents itself; much personal propaganda can be accomplished, and if the result is to obtain a satisfied consumer the trouble will be well repaid.

My thanks are due to my Chief, Mr. A. Pickering, for permission to read this Paper, and for the interest he has taken in its preparation.

Discussion.

The CHAIRMAN (Mr. J. W. Pallister, of Middlesbrough) complimented the Author on having given them so informative a Paper on a subject with which they had not dealt before.

Mr. D. A. PRATT (York) said that Mr. Aynsley had rightly emphasized the necessity of service to the consumer. He did not entirely agree with the system of a bonus to collectors for the number of calls made, for the collector was also a canvasser and the liaison between the company and the consumer. His own experience of several undertakings was that where fittings needed some adjustment they were not used. If collectors had an eye on the bonus, they were more likely to concentrate on the number of calls they could make rather than lose time in getting particulars of fittings needing attention. He thought that the bonus would be more effective if based on the number of reports as to adjustments at places where calls were made rather than simply on the number of calls made. The unremunerative consumer was the problem of the small undertaking. It would be interesting to know if any bonus were paid to the collector who could encourage these consumers to become remunerative consumers.

Mr. G. NEIL (Southampton) said their collectors were too busy to do any other work, such as canvassing, for which a separate staff was engaged. On the other hand, the collectors delivered hire-purchase accounts and collected payment for them, partly out of rebate. The bonus system was interesting and appeared to result in a very high number of calls per day. He was rather at a loss to account for the very big difference between the 55 calls in the March and June quarters and 70 for September and December quarters. At Southampton they had effected considerable economy by reducing the calls from three per quarter to two, and, on the face of it, the South Shields reduction to one visit appeared too drastic and, moreover, the cash boxes might be too full. It was interesting to note that the South Shields average consumption per prepayment consumer was lower than the Southampton figure of 19,400 cu.ft., although the price for slot meters was 1s. per therm against South Shields 8·2d. Their average clearance at one visit would appear to be about the same as that at Southampton—namely, 12s. 9d. per meter. The collecting card gave the collector the last index of the meter. They thought that inadvisable in that it might lead to falsification. Their collectors were not given the preceding reading, and the checking of cash against consumption was done by juniors in the office. He would like to ask why the van did not take the copper direct to the bank.

Mr. F. NICHOLLS (Gateshead) said he would have thought that the number of calls made would be fewer in the heavier quarters when the collectors had more to carry and more to count. The reason for the change from the motor-cycle to the car did not seem to him to be very convincing.

The CHAIRMAN asked the Author what was the average amount per meter per year. Taking the figure of £300,000 collected in 8½ years or about £35,000 a year, it would probably work out at about 24s. with an average of 30,000 consumers as at the end of 1932. In Middlesbrough the collections averaged 35s., requiring two collections per quarter. They did not believe they could manage with only one inspection a quarter. He could endorse the Author's remarks about the advantages of a motor-van for collectors; they had found considerable benefit in the change.

Mr. A. O. OLD (West Hartlepool) said he thought the meter department was the Cinderella of the Industry. In considering the duties and capacity of collectors, it had to be remembered that if the wages offered were little more than that of a labourer then they could expect to attract the type of man according to the wage. He did not agree that quarterly inspections were more advantageous than more frequent collections. With a single quarterly collection there was always the chance of meters being tampered with and not being quickly discovered.

Mr. AYNSLEY, replying to the discussion, said that the January and March quarters were the heaviest because from January they started systematically to clear meters for the heavier load commencing with the dark nights from October 1. Similarly in April they cleared meters for the previous quarter. Mr. Neil had remarked on the average of 19,000 cu.ft. per consumer at Southampton as compared with that at South Shields, but it must be borne in mind that there was some unemployment in the area. The numbers, however, made it worth while. Where no consumption was recorded over two quarters, they ordered the meters out, and that seemed to bring the consumers up to scratch.

As to the possible number of calls per day, one collector, for a wager, made 100 in a day; but collections were regulated in such a way that canvassing did not affect the bonus. Mr. Neil had mentioned the advantage of taking the copper direct to the bank, but they had an arrangement with the principal banks in the town whereby the copper was parcelled up by the Company and the banks called each day in rotation. The system was found convenient. They had found the change-over from motor-cycle to motor-van worth while; it also afforded more protection for the man in bad weather.

Collections were made by rotation and a check provided on the men by allocating them to different areas so that one man never went to the same district twice in succession. Mr. Pallister's undertaking could count itself fortunate in having an average meter collection of 35s.

South Shields was not so fortunate, but the Company had made a point that all poorer consumers should be treated with the same courtesy and attention as those who came in fur coats. There was a very natural tendency on the part of most staffs to judge people by their clothes. Their collectors were efficient in their work and took an interest beyond it, for some of them occasionally were able to assist in the office.

There were remarkably few shortages in the meters, and where this did occur there was little or no loss involved because a considerable rebate was allowed, and this was deducted according to the shortage if they occurred. It was interesting to note that when two or three years ago a drive was made by the electricity undertakings for more lighting consumers, a census showed that out of 30,000 consumers, some 20,000 still used gas partly or wholly for lighting while in Jarrow, a town hit hard by the depression, and in Hebburn about 75% of the consumers used gas for lighting.

Mr. R. HARLE, of Thirsk, proposed a vote of thanks to Mr. Aynsley for the Paper, which, after being seconded by Mr. F. NICHOLLS, was carried with acclamation.

A Hundred Years of Gas at Newmarket

Centenary Luncheon

To mark its centenary, to which reference was made in a recent issue of the "JOURNAL," the Newmarket Gas Company gave a luncheon at the offices of the Company on Nov. 24. Among the guests were Mr. F. B. Richards, M.Inst.C.E., Chairman of the Woodall-Duckham Companies, Mr. W. Ross Taylor, M.P., and Captain F. F. A. Heilgers, M.P.

In proposing "The Newmarket Gas Company," Mr. Richards gave a brief history of the Company from the time when gas was first introduced to the eastern counties in 1837 by John Malam. No history of the Gas Industry at Newmarket, he said, would be in any way complete without mention of Mr. Troughton, the present Chairman, who had been connected with the Newmarket Gas Company for 55 years, more than half the period of its existence. First appointed Assistant in 1882, Mr. Troughton became Manager in 1890, serving in that position for 45 years. During a very active career, said Mr. Richards, Mr. Troughton had always been on the side of progress and had been a strong advocate of education, advertising, and research. He had served on the Council of the former Gas Institute, now The Institution of Gas Engineers, and had been President of the Eastern Counties Association. Mr. Richards concluded by wishing the Newmarket Gas Company "Many Happy Returns" and expressed his lasting confidence in the future of the Gas Industry.

In reply, Mr. Troughton referred to the services rendered to the Company by the late R. Stephenson who served as Chairman of the Directors from 1876-1929, a period of 53 years. He then went on to relate some amusing incidents which had occurred during the time he was Manager of the Company. Within his memory there had never been a "black out," and although on many occasions, during Race weeks, the gasholders had been empty, yet they had always managed to maintain the service, gas passing direct from retort to burner. The aim of the Newmarket Gas Company had always been to serve its public and in this, said Mr. Troughton, he thought it had succeeded.

Mr. E. R. Ennion proposed the "Town and Trade of Newmarket," to which Messrs. H. R. Buck and W. D. Gilbert replied.

The toast of "Our Guests" was briefly given by Mr. J. L. Jarvis and responded to by Mr. Ross Taylor in a very amusing speech.

YORKSHIRE JUNIOR GAS ASSOCIATION

Presidential Address

OF

J. H. RICHMOND,

of the York Gas Company.

Read before a Meeting of the Association at York on Nov. 20.

THE PRESIDENT.

"THE YORK KLÖNNE DRY GASHOLDER"

Historical.

In considering the dry gasholder one is apt to look upon it as essentially a recent development. This is scarcely true, as the first patents for such a holder were taken out in Germany by the firm of Aug. Klönne, Dortmund, in 1882.

The Klönne holder has developed from small holders, the first of which was constructed at Dortmund in Germany in 1927 and had a capacity of 175,000 cu.ft. At the moment there is a Klönne holder in course of construction at Gelsenkirchen-Buer, Germany, with a capacity of 21 million cu.ft. It should be mentioned that when the York holder was built in 1931 it was the largest of its type in the world, and the first to be constructed in this country. There are now seventy-one holders of this type, having a total capacity of 120 million cu.ft.

For the purposes of this Paper I propose to deal with the Klönne dry holder commissioned by my Company in 1931.

Construction.

The main dimensions of the York holder are: 126 ft. diameter. 180 ft. 6 in. from bottom plates to top curb. Capacity: 2 million cu.ft.

The shell is cylindrical and formed from curved steel plates which are riveted to steel joists, acting as vertical columns, and to horizontal rings of channel section, acting as stiffeners. The vertical column joints and horizontal channel joints are butted, and all rivets are counter-sunk and ground flush on the inside of the shell to ensure a smooth and easy travel for the piston. The vertical columns are anchored by bolts to the ring wall foundation. In addition to the horizontal channel stiffeners there are five galleries, these serving the dual purpose of stiffening girders and painting and inspection platforms.

This design results in a remarkably clean construction, pleasing to the eye, and at the same time giving the immediate impression of a piece of fine engineering construction. The bottom plates are bedded on sand resting on a thin concrete raft, and are fixed to the shell by means of inside and outside angles.

The top of the holder is dome shaped and of strong design. The piston design closely follows that of the roof. The sheeting of the crown and piston top is riveted to the channel framework. All joints are taped in the usual manner to ensure tightness. The construction of the piston and the sealing arrangement are primary characteristics of the Klönne holder and, therefore, of special interest.

The bottom edge of the piston carries a ring of closely pitched guide rollers, and a second and similarly pitched ring of rollers is carried at the top of the piston superstructure. The vertical distance between the two sets of rollers is approximately one-eighth the diameter of the piston, or, in the case of the York holder, 15 ft. 6 in. The rollers in each ring are approximately 4 ft. apart, thus allowing for 96 rollers per ring. This arrangement is sufficient to keep the piston in a horizontal position. The rollers are built up of laminations of selected elm wood, having at each end metal sheaves through which the spindles are carried. As the surfaces of the rollers are convex, there is no metal-to-metal contact during movement. There are no vertical guides for the rollers, therefore the piston is free to rotate, and in practice it is found that there is a tendency for the piston to rotate from the vertical during its travel. Probably this can best be described as a "corkscrew" movement. That is to say, from the bottom to the top of the gasholder, the piston does not follow a truly vertical path, but over this distance, say, 140 ft., rotates to the extent of some 3 ft., and on descending retraces the same path.

Above the lower ring of rollers and attached to the superstructure of the piston is a circular steel trough filled with creosote oil. The flexible steel ring to which is attached the packing ring is suspended in this trough, and is free to move, thus giving the packing ring freedom to adapt itself to any slight irregularities in the steel shell. The packing ring serves to seal the space between the flexible plate and the shell, and the oil trough seals the space between the plate and the piston.

The packing ring is pressed against the shell by a series of bell-crank levers carrying weights, which bear on a wood-filled channel ring attached immediately behind the packing ring. The packing ring itself is constructed of a cotton fabric specially vulcanized with a gas-resisting compound, arranged in two groups of three layers each, having a space between the two groups. The ring is lubricated through the space by means of Stauffer cups, using a specially prepared grease. This grease remains unaltered in composition and properties over a wide temperature range, and is chemically inert to coal gas.

The piston in the York holder was so designed as to throw an 8 in. water gauge pressure and, if desired, to permit of extra weight being added in the form of concrete blocks distributed evenly over the surface of the piston to increase this pressure to 10 in. water gauge.

The holder is ascended by means of an external staircase to the crown. For internal inspection an electric hoist is fitted. This hoist has guide ropes and all the usual safety gear associated with passenger lifts. A special feature of this hoist is the automatic control gear. As the piston height is constantly varying, it will be appreciated that a constant control point is impossible when the lift is descending. By means of a relay, and gearing operated by wire rope from the piston level, an automatic stop has been arranged. The top point of travel of the lift being a fixed point, the usual trip gear is employed. All controls are external and are housed in a small motor house on the crown.

In case of emergency, provision for over-filling the holder is made by incorporating four perforated sheets at the topmost position of the piston travel. These sheets are in the third ring of sheets from the top of the holder, and should gas continue to be admitted to the holder after the piston reaches this point the gas passes out through the perforations and is carried clear of the holder by means of vent pipes attached to the outside of these sheets.

In addition to the vent pipes there is installed a safety seal device. This is situated adjacent to the main inlet, and consists of a 12 in. pipe sealed to withstand 12 in. w.g. On the outlet of the seal pot is a 12 in. pipe running to the top of the holder. Should some fault occur inside the holder and cause the piston to throw more than the normal 10 in. w.g., the safety seal would blow at 12 in. and so relieve the pressure on the piston. Various pressure gauges are employed at control points, so that such an occurrence would immediately be observed and attended to. Ventilation of the space above the piston is provided by louvred sheets at the top of the holder, and also by the wide louvres in the turret in the centre of the crown. Light is obtained from the windows carried in the second

side sheet from the top of the holder, and also from the louvres.

Notes on Erection.

As the method of erection of this type of holder differs greatly from normal practice, a few notes might prove of interest.

First, it should be mentioned that the holder is built on a ring wall foundation, fabricated of reinforced concrete, the wall being in the shape of an inverted T. To this wall the columns are anchored. The bottom sheeting is laid on a thin concrete raft merely to ensure a level surface, as it will be appreciated that no weight is carried, other than that of the bottom sheeting itself, and the gas pressure.

After foundation levels have been carefully checked, the 24 rolled steel joist columns are positioned, levelled, and plumbed. These columns are then temporarily braced with accurate spacing to keep them perfectly vertical and ready to receive the next rise. The fourth tier of side sheets, together with their stiffening channels, are then positioned, and these are later used as a girder for the positioning of the peripheral portions of the piston.

The starting plates of the bottom along with the bottom tier of side plates are then erected, this method being adopted to form a plate girder for stiffening purposes while lowering the bottom on to the foundation. The remaining bottom plates are then positioned, riveted, tested, and lowered in the usual way by means of screws.

The next step is to erect the oil sealing trough; this is riveted above the level of the first ring of side sheets, and subsequently raised by means of screws to allow the second and third side sheets to be erected. When these are in position the oil cup is lowered into position for attachment to the piston.

The piston now begins to take shape—the members carrying the sheeting are built up on timber supports and riveted together. Following this the packing ring is positioned and attached to the apron plate, which in turn is attached to the piston superstructure carrying the rollers. The piston now being completed, oil is placed in the oil cup and a blowing engine connected to the underside of the piston.

A temporary erection platform is constructed on top of the piston superstructure, upon which a derrick is housed. This derrick, running on rails, is used for all hoisting of materials and riveting stages during erection. The erection of the remaining side sheeting follows normal gasholder practice, with one exception. The vertical joints are continuous and therefore, unless provided against, would give rise to a leakage. To prevent this, these joints are caulked with a lead strip which is afterwards filed down to the plate level, completely filling the space between the plates, and providing a smooth finished surface.

The erection of the holder crown is an unusual job, and is of special interest because the floating piston is employed as a support for the crown timbering. The piston is raised by air pressure to the full extent of its travel, and upon the piston sheeting, supporting timbers for the erection of the roof are placed.

During the positioning and erection of the crown framing the air blower is in constant commission to ensure that no variation in the height on the piston takes place. When the structure is riveted the timbers are withdrawn and the crown sheeting completed.

Before commissioning the holder for gas, extensive tests are made under air pressure. When finally satisfied with tests, the underside of the piston is purged free from air, continuous samples being taken until complete purging has been attained.

The Holder under Working Conditions.

As would be expected when commissioning a new type of holder, and one of such capacity, every opportunity was taken at York to obtain as much data as possible as to the performance of the holder.

Perhaps the best way of considering the working of the holder would be first to go over the main points to which attention is directed in practice.

(1) *Lubrication of the Packing Ring.*

As previously mentioned, the method of lubricating the packing ring is by large capacity Stauffer cups placed at intervals round the packing ring. These feed grease into the space between the two groups of packing. In this way it was expected that the ring would be itself lubricated and also carry as a film sufficient grease to lubricate the side sheeting.

In practice this was not found entirely satisfactory, as a good deal of the grease was swept off the packing and deposited on the underside of the piston, eventually falling to the bottom of the holder and being lost. In addition to being wasteful and costly, this method did not give a sufficiently even distribution of grease over the surface of the side sheeting. The method devised and operated is to brush the grease on to the side plates, in a narrow ring, or a complete width of side sheet as desired. This can be done easily by one man in half an hour, and it has been found that a beautifully even coating of grease can be maintained over the whole sheet surface. The Stauffers are now merely used to keep the packing itself greased. The grease used has 10% of graphite incorporated, and this has been found advantageous, and after 6 years of work the side plates are now wonderfully smooth and almost polished. The frequency of greasing depends largely upon the weather and time of year, and may vary from once a fortnight in the summer to twice a week in damp, foggy winter weather. It should be noted that the grease is brushed on, and is applied to the tier of sheets above the piston at the time of greasing. As the piston position is constantly varying, different portions are greased each time, so giving an even distribution over the whole surface.

(2) *Inspection of Packing Ring.*

For the purpose of greasing and also for inspection of rollers and packing ring, a platform is arranged immediately above the bell-crank levers. When first put to work the bell-crank levers carried three weights, bearing to their full extent on the packing ring. With the bedding of the ring and regular lubrication it has been found possible to remove approximately one-third of these weights, and also to move them inwards towards the ring, thus reducing the effective thrust on the packing.

The effect of this may be judged when it is known that at the outset the friction of the piston accounted for 1¾ in.-2 in. w.g., and now after the removal of weights, as described, this friction has been reduced to 1 in. w.g., at the same time maintaining a perfectly gas-tight seal.

The atmosphere inside the holder is truly remarkable, and this perhaps will be more readily appreciated by the fact that racing pigeons affected by bad weather have been frequently found resting in the holder, in which the atmosphere is always perfectly fresh.

Rollers.

The adjustment of the rollers is an important point, as these must be kept adjusted so that each one is bearing equally. Slight tolerance is allowed of necessity to allow for the small irregularities in the shell, but this should never exceed ⅛ in. As formerly mentioned, these rollers are of elm, but recently bakelite rollers have been satisfactorily adopted in some holders.

Oil Seal.

The periodic testing of the seal for level is necessary to ensure that no leakage is taking place. The oil being of a stable character, no variation due to evaporation is experienced.

Piston Level.

In order to check the adjustment of the rollers and to ensure that the piston is travelling normally, the level of the piston is checked daily.

The levels are taken at four points, A, B, C, D, A C and B D being across the diameter and at right angles to each other. In normal weather the tilt varies from 1 in. to 2 in., but during hot, sunny periods, when one side of the holder is subjected to the hot sun, consequent slight distortion of the side sheeting takes place, and under these conditions tilts may vary to the extent of 4 in.-4½ in. In addition to actual measurement, a recording device has been arranged to give a continuous record.

As the air above the piston is subject to atmospheric changes the side plates are often charged with moisture due to condensation; this is often the case during foggy weather. If such conditions are accompanied by sharp night frost of, say, 10°-12°, hoar frost and much ice may be found on the side plates above the piston. It is also possible to get ice formed in the packing ring itself due to condensed water running down the side sheets and on to the ring. In the first winter the holder at York was at work ice formation took place, but was immediately dealt with by the addition of glycerin to the packing ring. During frosty periods it is now normal practice to mix glycerin with the lubricating grease, and also to keep small quantities supplied to the ring. In this way no further trouble has been experienced, and it is of interest to note that a Klönne holder in Syracuse, U.S.A., has worked perfectly with no trouble whatever in temperatures of 24°

below zero, the glycerin treatment having prevented ice formation.

A daily routine inspection is carried out and logged, consisting of:

1. Piston levels.
2. Position of piston.
3. Condition of side plates.
4. Condition of packing ring.
5. Condition of levers.
6. Condition of rollers.
7. Grease used.
8. Maximum and minimum temperatures.
9. Safety seals.
10. Lift inspection (weekly).

Gas as Applied to The Textile Industry

by
D. STANLEY DAVIES,
Assistant Engineer and Manager,
Vale of Leven Gas Company.

From a Paper read before a meeting of the Scottish Junior Gas Association (Western District) at Glasgow on Nov. 13—the PRESIDENT, Mr. R. A. MacLaren, of Newton-on-Ayr, presiding.

The sale of gas by the Vale of Leven Gas Company during 1936 was 134·5 million cu.ft. Of this amount, 15·5 million cu.ft. were sold industrially—a percentage of 11·7. For the first six months of this year the percentage had increased to 14·7. The Company supplies the districts of Alexandria, Balloch, Jamestown, Bonhill, and Renton, which are situated on the River Leven, which is the outflow from Loch Lomond, whereby an abundant supply of good soft water is at hand. So naturally, the chief industry of the district is the dyeing and finishing of textiles. The part which gas plays in textile manufacture is, first, in the spinning and doubling mills, where it is used for singeing yarns individually. We have no mills of that description in our area.

Gas next plays a part in the finishing works—first, singeing the cloth; secondly, the heating process called stenting, which is the conditioning or normalizing of the cloth after it is passed through bleaching and other processes. The next and final heating process, for which gas may be used is calendering, where the fabric receives its finished lustre.

Singeing.

Singeing machines are employed in the preparation of the fabric, previous to the bleaching, to remove the fibres projecting from the fabric, with the object of enhancing the effect of the subsequent finishing operations. These machines can be divided into two classes:

(1) Plate Singeing Machines, using one or more heated copper plates, with which the cloth makes contact.
(2) Gas-Flame Singeing Machines, in which the fabric passes over or through the gas flame.

Plate Singeing Machine.—This machine is usually arranged with one or two plates which are of copper, arc shaped, generally 6 ft. in length, 2 in. thick with a rise of 5½ in., and a radius of 8 in. The plate is heated by six "Selas" burners, which enter below the plate, the flames striking the inner side of the plate, which is heated to a temperature of 850° C. in approximately 25 minutes. The fabric, in passing through the machine, is pressed upon the copper plate or plates by metal guide rollers. The machine itself is fitted with a traverse motion, so that the line of contact of the fabric on the plate is varied continuously to prevent wear of the plate, which would mean uneven singeing. At the present moment, we are experimenting at the Works with a singeing machine of this type, using surface combustion of the arc, four burners being built into the bottom of the plate, and the results we have obtained so far are very satisfactory. We are able to heat the copper plate to the required temperature from cold in half the time it takes to heat it with oil, with which until recently this machine has been heated. We can show more efficient and economical working. The gas consumed is 750 cu.ft. per hr. of 410 B.Th.U.

Gas-Flame Singeing Machine.—There are a number of types of burners which may be used in these machines. One type, which is installed locally, is very interesting. The length of the flame can be altered to suit the various widths of fabric passing through the machine by means of compressed air, which enters from the opposite side of the burner to that of the gas-and-air mixture, or it can be altered by means of an inner sleeve which closes the gasway to the required length. This burner is of the slotted type. Another type of burner is one in which four gas flames emerge from a longitudinal slit arranged parallel to the weft of the fabric, and in this way the cloth is successfully singed when passing through the flames.

Stenters.

These machines receive the dyed materials in a moist condition and, as the name implies, stretch and dry the materials.

The fabric, after being stretched in the first part of the stenter, is dried by means of heat, which operation can be done by gas, oil, hot air, or electricity. When operated by gas, an arrangement of one, two, or three sets of gas jets, which in the case of two or three sets, are placed about 12 ft. apart, and 6 in. below the chains. In one type, the gas jets are obtained from a number of bar burners, 4 ft. long, twelve in a series, each burner consisting of 144 jets. In another type the burners, which are similar to the above, are placed under a number of iron frets as those used on an ordinary gas cooker. From experience, this type has not proved very successful, the reason being, if the stenter should accidentally stop and the gas is immediately turned off, due to the heat still retained by the frets, the cloth is liable to catch fire.

There are other methods of heating with gas, but these two types I have described are the ones used in our district.

It is difficult to give any definite figures as to the gas consumption per hour, as stenters are worked under such varying conditions, with cloth speeds ranging from 10 to 90 yds. per minute. Gas consumptions vary accordingly, but we find that taking a cloth speed of 50 yds. per minute, the gas consumption would be in the region of 300 cu.ft. per hour for each set of gas jets for cloth in a normally moist condition.

Calenders.

These machines are employed for the purpose of giving any desired density, compactness, or lustre to the fabric, and the design of this machine will no doubt be familiar to many of you, as they are similar in several respects to starch mangles used in laundries, which are constructed of metal and non-metallic bowls, maintained under pressure and which may rotate at the same or different speeds in relation to each other. The difference being that the bowls in these machines are made of iron or steel and are hollow so that they can be heated.

There are a number of types of calenders—viz., glazing, swissing, schreiner, and embossing. The types differ in regard to the number and character of the bowls used.

Glazing Calenders are built up of bowls rotating at different speeds in respect to each other and the friction produced gives a fabric a high lustre.

Swissing Calenders are built up of bowls rotating at the same speed and, in passing through the bowls, the fabric is compressed so that it has a smooth compact appearance but with only a moderate lustre.

Schreiner and Embossing Calenders use engraved steel bowls and give a fabric special lustre.

The pressure on the bowls of glazing and swissing calenders is generally obtained by means of weights and compound levers, but with schreiner and embossing machines, where a pressure of over 1 ton per sq.in. is required, hydraulic means are used.

These various calenders are heated by means of a gas burner, placed inside the drum, and can be heated up to

working temperatures very quickly. With "Selas" burners, they can be heated in as little time as 15 minutes.

The average cloth speed with calenders is approximately 60 yds. per minute. Certain calender burners are arranged for a maximum gas consumption up to 50 cu.ft. per hour for every 12 in. width of working face on the calender bowl. This rate of consumption is only necessary during the heating from cold. Most calenders require only about 20% of the maximum consumptions for maintaining temperatures under ordinary working conditions, and calenders of the friction type, which generate heat, require no gas at all after the initial heating period.

The gas load of a textile factory differs somewhat from most industrial loads, which are fairly constant for specified periods. For instance, in a textile factory the load will vary according to the size of the factory and the rate at which the material is being despatched from the dyeing department. This means that on a gas-works where perhaps only 300,000 cu.ft. are made per day in the summer, a sharp eye has to be kept on the amount of gas in the holders, so that the make in the retort house can be regulated to meet this varying load.

With silk becoming more popular in recent years, the dyeing and finishing of pure and artificial silks has become established in our area. Recently a factory has been built for this purpose. In 1932 the contract for a gas supply was settled and the work of laying a main to the factory was commenced. The machines operated by gas in this factory consist of seven stenters, two singeing machines, and five calenders.

The following table shows the monthly gas consumption in this factory from the time gas was first used in 1932 up to the present time, and you will observe that a considerable increase has been attained. It will be noticed that the July consumption for the last two or three years has been down; this is due to the holiday period for a number of employees in the factory.

It will be noted that cloth speeds in each case are entirely dependent on the auxiliary machinery working in conjunction with the singeing machine. Also the number of yards singed per penny is calculated on gas cost only. Labour and other incidental charges have to be added to obtain overall singeing costs.

Discussion.

Mr. STURROCK (Greenock) said that this was the first Paper of this type which he remembered having been presented to the Association. He was sorry that he had no experience in the use of gas in the textile industry as applied to cloth manufacture, and he was thus at a disadvantage to discuss the Paper. He was very interested to see a marked increase in consumptions since Alexandria had obtained this load, and he would like to know if the carbonizing plant had been extended to meet this additional load.

Mr. E. G. SMITH (Dumbarton) was of the opinion that gas was the most suitable fuel for this class of work, having regard to its cleanliness and ease of control. He was also interested in the price obtained and asked if this was competitive with oil.

Mr. J. BATEMAN (Kilmarnock) said that, being a works man, it was of great interest to see the uses to which gas was put. He appreciated the difficulties which Mr. Davies was up against in maintaining a constant calorific value in so far that the varying composition of the gas affected the flame temperature and was liable to damage the cloth.

Mr. ANDERSON (Alexandria) said oil could not be used for singeing, as the cloth was much too delicate. The process involved a Swiss patent, and they had great difficulty in obtaining any information.

Mr. T. SAWERS (Perth) was surprised to learn that difficulty was experienced in this direction, and said that the corrugations of the burners were similar to some fire burners. In this type of burner the bar slides out and in from either side in order to regulate the length of the flame to the breadth of the cloth when singeing, and asked if any difficulty had been experienced with the burners due to these bars sticking after being in use for some time. He also asked if the cloth was damped before or after the singeing and was it done to both sides simultaneously.

Mr. L. NICHOL, Junr. (Greenock) asked Mr. Davies if he could give any figures showing the effective saving from oil for this class of work.

Mr. J. WEBSTER (Port Glasgow) said that where the "Selas" system of high-pressure air was in being it was ideal for lighting the factory. In Port Glasgow they had a consumer with this system, and recently, when the factory was extended, the lighting system was also enlarged. Had Mr. Davies any experience in this direction? He would also like to know if any attempt had been made to control the singeing plant thermostatically.

Mr. R. A. MACLAREN (Newton-on-Ayr), with reference to singeing machines, said that he would be glad to know if trouble did not arise from oxidation of the copper plate in contact with flame. What method was adopted to keep them clean, as it appeared to him that this was a potential source of loss of efficiency in heating and was liable to put up the gas consumption unduly.

Mr. DAVIES, replying to Mr. Sturrock, said that they were fortunate in having the necessary plant available at Alexandria to meet this additional load. In reply to Mr. Smith, Mr. Davies said that gas was a necessity to them and the firms were prepared to pay for the facilities. It competed most favourably with oil, and in heating gas could do the job in 20 minutes as against 45 minutes' heating by other methods.

Mr. Davies informed Mr. Bateman that the calorific value of the gas was as far as possible kept constant. Regarding Mr. Sawers' remarks, they had experienced no trouble so far with the bar corroding; the cloth was damped before the singeing process.

Replying to Mr. Webster, Mr. Davies said they had no thermostatically controlled burners, but the men who operated were so experienced that their touch was sufficient to keep the rolls at the correct temperature. Replying to Mr. MacLaren, Mr. Davies said that they had no experience of oxidation of the singeing plant, and to his knowledge no scale had formed. Gas was used in preference to hot air. It gave finer "touch," resulting in a more satisfactory material being produced.

TABLE *showing the Amount of Gas in Cu.Ft. Consumed Monthly by a Textile Factory in Alexandria since Gas was first Installed up to November*, 1937.

[Total amount consumed from May, 1932, to October, 1937, inclusive was 49,210,100 cu.ft.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1932 . .	..	..	..	..	3,800	4,000	2,400	3,600	3,200	3,400	67,700	211,000
1933 . .	193,000	205,000	291,000	287,000	454,000	549,000	496,000	610,000	493,000	493,000	524,000	464,000
1934 . .	464,000	609,000	762,000	586,000	814,000	667,000	623,000	666,000	724,000	934,000	657,000	618,000
1935 . .	654,000	672,000	732,000	728 000	806,000	667,000	681,000	1,131,000	1,005,000	1,216,000	1,066,000	1,127,000
1936 . .	931,000	1,184,000	1,067,000	830,000	761,000	739,000	673,000	1,078,000	929,000	1,446,000	1,245,000	1,119,000
1937 . .	1,103,000	1,158,000	1,323,000	1,373,000	1,204,000	1,417,000	1,062,000	1,548,000	1,440,000	1,619,000	..	..

I am able to give the following data on gas singeing machines which will give you a good idea of the low expenditure when using gas in these machines:

Data on Four Gas Singeing Machines.

1.—Plant installed	"Selas" 4-burner machine
Average cloth width	54 in.
Average cloth weight	21 lb.
Average cloth speed	120 yd. per min.
Total cloth singed per hour	7,200 yd.
Gas consumption per hour	800 cu.ft.
Gas cost per 1,000 cu.ft.	3s. 4d.
Cloth singed per penny	225 yd.
2.—Plant installed	Four singe plate furnaces fitted to two existing machines—two furnaces on each machine
Average cloth width	58 in.
Average cloth weight	30 lb.
Average cloth speed	150 yd. per min.
Total cloth singed per hour	18,000 yd.
Gas consumption per hour	3,000 cu. ft.
Gas cost per 1,000 cu.ft.	3s.
Cloth singed per penny	166 yd.
3.—Plant installed	"Selas" 4-burner machine.
Average cloth width	50 in.
Average cloth weight	25 lb.
Average cloth speed	130 yd. per min. (Double side singeing)
Total cloth singed per hour	7,800 yd.
Gas consumption per hour	900 cu.ft.
Gas cost per 1,000 cu.ft.	4s.
Cloth singed per penny	180 yd.
4.—Plant installed	Two "Yorkshire" type singe plate furnaces fitted to existing machine
Average cloth width	68 in.
Average cloth weight	40 lb.
Average cloth speed	120 yd. per min.
Total cloth singed per hour	7,200 yd.
Gas consumption per hour	1,500 cu.ft.
Gas cost per 1,000 cu.ft.	3s. 6d.
Cloth singed per penny	114 yd.

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Electricity on Gas-Works

by
S. G. MELVILLE

An extract from one of the Papers read before the Scottish Junior Gas Association (Eastern District) at a Short Paper Meeting at Edinburgh on Nov. 6.

The main reasons for installing electric motors as prime movers on Gas-Works have been summarized by Colonel W. M. Carr as follows:

(*a*) To effect a saving in power costs.
(*b*) For the working of such units of plant as cannot be satisfactorily driven by any other type of power converter.
(*c*) To secure certain advantages and conveniences which are characteristic of electric driving, the value of which to the user cannot be expressed in terms of pounds, shillings, and pence.

Taking each of those reasons separately and going into a little more detail with special reference to the conditions at the Granton Works, with which I am most familiar, we have:

(*a*) To effect a saving in power costs.—At Granton, prior to the introduction of electricity, the coal breaker and elevator and coke conveyors were driven by a large single cylinder horizontal steam engine. The power was transmitted through long lengths of shafting with many bearings and several bevel gears, all of which caused large friction losses. Also, the same engine was most inefficient when running lightly loaded on a single unit of plant. The present day practice is to have a separate electric motor, carefully chosen with regard to size, coupled to each unit of plant. The power demand is then only that required for the plant in operation at the time. The transmission of power by means of electricity is a highly efficient process which is comparatively cheap to install. Electric energy differs in one respect from other sources of power in that any leakage shows itself immediately by operating protective devices, whereas leakages on other systems such as steam may pass unnoticed for long periods. Another advantage is that electrical power consumption can be easily and accurately measured, thus enabling the maximum efficiency to be maintained.

The comparative efficiencies of various prime movers run somewhat as follows:

	%
Steam engine	10–20
Gas engine	25–35
Electric motor	80–90

While on the subject of efficiency, it may be of interest to recall the fact that, although the electric motor itself has a very high efficiency, the process of generating electricity by means of steam from coal-fired boilers has an extremely low efficiency of the order of 20% to 25%. Where waste-heat boilers are installed, the cost of producing electricity on a gas-works can be reduced to a very low figure. If arrangements are made to use the exhaust steam from the engine for process work, such as steaming retorts or operating a sulphate plant, the cost of generation, inclusive of capital charges, may be less than ¼d. per unit.

We now come to reason (*b*) for using electricity—namely, "For the working of such units of plant as cannot be satisfactorily driven by any other type of power converter." A very good example of the use of electrical energy under this heading is the electro-static precipitation of tar fog.

Electro-Detarrer.

An exceptional feature possessed by the electro-detarrer is the extremely low back pressure thrown by the treatment vessel. At Granton the back pressure for a treater dealing with 5 million cu.ft. per day is only three-tenths water gauge, and the extraction efficiency is 99·7% with an outlet fog content of less than one grain per 100 cu.ft.

Using the older system of tar fog elimination such as the P. & A. tar extractor, the differential pressure required is about 4 to 6 in. water gauge and the extraction efficiency only about 60-70%. The complete elimination of tar from the gas enables the washing and scrubbing plant to work much more efficiently and with longer intervals between cleanings. Purifiers and benzole plant also show a much improved performance. It may be of interest here to say just a word with regard to the production of the high tension direct current for use in the detarrer. There are several methods in use at present. Probably the simplest method, where a supply of alternating current is available, is to raise the supply voltage by means of a static transformer, the output from which is changed to direct current by means of a suitable rectifier. At Granton we use another method, whereby the high voltage current is generated by means of two specially wound dynamos coupled in series and driven by an electric motor running off the Works' supply. Incidentally, these special generators may be driven by a steam engine if no electric supply is available.

As the generators have to be within a reasonable distance of the treater vessel, special precautions have to be taken to prevent any hydrogen sulphide gas from reaching the commutators of the machines, otherwise serious corrosion may occur which will give endless trouble with shut-downs.

An average figure for power consumption is 1 kWh per 100,000 cu.ft., which with the electric current at 0·5d. per unit is 5d. per million cu.ft. Operating costs are extremely low, as depreciation, repairs, and maintenance are almost negligible.

We now take reason (*c*) for using electricity—namely, "To secure certain advantages and conveniences which are characteristic of electric driving." Under this heading we have the convenience of distant control and the capability of the electric motor to run for long periods without any attention as regards lubrication, &c. A good example of ease of control is seen in the modern sequence switching of a series of electrically driven conveyors, where by pressing a single button a complete set of conveyors can be started or stopped in the correct order. The proper time delay is automatically introduced, so that on pressing the stop button in an emergency, the conveyors are brought to a standstill without any damage due to the piling up of material at any point. Again, the electric motor is capable of a wide variation of speed simply by the turn of a regulator. A useful instance of this feature is shown in the extractor drive on a vertical retort plant. Once the individual drives have been adjusted, and, provided the coal quality is fairly uniform, the rate of through-put can be varied within fine limits by variation of motor speed. An instance of automatic speed control is seen at Granton in the compressor feeding the high-pressure gas main. This control maintains the gas pressure at any required setting by means of a pressure gauge fitted with upper and lower limit contacts which automatically vary the speed of the electric drive.

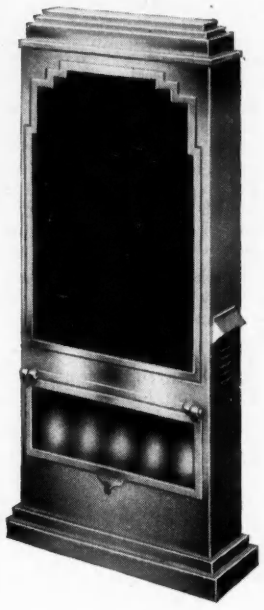
Still another instance of the convenience of the electric drive is seen in the Summer Coke Screen. This consists of a rectangular mesh screen, the centre of which is vibrated rapidly by means of a link attached to a plunger working in a solenoid. The winding on the solenoid is fed with specially generated low frequency alternating current which conveys its rapid alternations to the plunger.

Under this heading, there are many instances where electricity is the most convenient source of energy. A few may be mentioned as follows: Operation of lifts in retort house and on the waterless holders by means of press buttons to the various levels. The indication, at a distance, of pressures, temperature, and calorific value. Automatic control of gas valves at a distance. Operation of ticket-printing weighing machines, bag-filling machines, and mechanical calculators. Driving pumps for circulating the wash oil on benzole scrubbers. An interesting feature in connection with these pumps is the fact that they are fitted with automatic starting gear which enables them to recommence working after a temporary shut down. Normally, an electric motor has to be started by hand control after a current failure. Finally, we have portable rubber band conveyors for loading or unloading coke or oxide at any part of the works.

Economic Advantages Outweigh Prejudice.

To some, the use of electricity on a gas-works may seem anomalous, but the economic advantages of electricity are great enough to outweigh any prejudice against its use. The important point is that, in nearly all cases, electricity can be generated on the works at a cost lower than that of the local supply.

Although electricity can be put to so many uses on a gas-works, there still remain certain units of plant which are more conveniently operated by steam. An example of this is the exhauster. The steam engine has the reliability and flexibility required for this special purpose. It must always be remembered that electrically driven



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plant is liable to sudden failure due to overloads or failure of supply, and a sudden stoppage of the exhauster on a large works would be disastrous. Other instances where steam is the better motive power are as follows: Waste-heat boiler fans, boiler feed pumps, pumping, or other services where sudden interruption will cause serious inconvenience in gas-making.

The comparative cost of generating electric current at Granton, by each of the three methods—steam engine, gas engine, or rotary converter, is as follows:

With steam from waste-heat boilers at 6·23d. per 1,000 lb. and using 30 lb. of steam per kilowatt generated, the cost per unit is 0·19d.

With gas charged at 1s. per 1,000 cu.ft. or 2½d. per therm, the cost per unit is 0·52d. In the case of the converter, the current is supplied by the Corporation Electricity Department at an average of 0·6d. per unit, and after conversion to 460 volts d.c. the cost becomes 0·66d.

The average cost of current for the year, allowing for wages, is 0·65d. per unit.

The total number of electric motors in use on the Works at Granton is about 120.

The sizes vary from small units of ⅛ h.p. to the largest, which develops 165 h.p. at its maximum speed of 750 r.p.m.

The most recent addition to the Works is a coke screening, weighing, and bagging plant. All the drives for the rubber band conveyors and the screens themselves are electric. This adds a further seven electric motors to the total employed.

Discussion.

Mr. A. C. Rea (Perth) said that many of the older school and some of the young also were prejudiced against the use of electricity on gas-works, but the most efficient means of power supply must be made use of and for many purposes electricity provided this. He thought that the figure of 0·19d. per unit was remarkable; did not Mr. Melville use the cheapest cost of steam for this? He thought that the average works price should be used, and not that of steam from waste-heat boilers. Could Mr. Melville say whether current at 460 volts a.c. was suitable for lighting?

Mr. T. B. Livingstone (Alloa) said that an electro-detarrer had just been installed at Alloa, and he believed that this was only the second plant to be installed in a Scottish Gas-Works. He agreed with Mr. Melville that it was a most efficient plant. In connection with the question of reliability, he thought steam could not be beaten, and had recently had experience of a steam pump being started up while covered to a depth of about a foot with ammoniacal liquor; he did not think an ordinary electric pump would have stood this.

Mr. J. Richmond (Penicuik) remarked on the efficiency of the electro-detarrer. He asked whether safety gas lamps could not have been installed in the benzole plant.

Mr. J. M. Dow (Kirkcaldy) said that the use of electricity depended on the size of the works. If it was used to any extent a skilled engineer had to be employed.

Mr. R. Cowie (Falkirk) also said that a skilled man must be employed, and raised the question of safety gas lamps.

Mr. Melville, replying, said that he had taken the cheapest cost of steam, and agreed that a higher price should be taken; but even if the figure given were two or three times as great it was still very low. He agreed with Mr. Livingstone that steam was more reliable, but in the case mentioned a totally enclosed electric motor would have done the job. In connection with gas safety lamps, he thought the objection was the cost as compared with an electric lamp. With regard to Mr. Rea's question about lighting, this voltage would be unsuitable for an ordinary lamp, as these only went as far as about 250 volts. This difficulty could be overcome, however, by using two lamps in series.

Ashby de la Zouch Gas Company

Application for Special Order

An application by the Ashby de la Zouch Gas Company for a Special Order to secure statutory powers, as required by the Gas Undertakings Act, 1934, was the subject of enquiry at the Westminster Offices of the Board of Trade, on Friday, Nov. 26, by Mr. J. F. Ronca, O.B.E. (Director of Gas Administration). The Order also provided for the extension of the limits of supply of the Company and for increase of capital powers.

Objection was raised by the Ashby de la Zouch Urban District Council with a view to securing the insertion of a clause giving the Council the right to purchase the undertaking. A further series of objections was made in writing by the Ashby de la Zouch Rural District Council, but the Rural District Council was not represented at the inquiry.

Putting the case for the Company, Mr. J. H. Lees (Messrs. Lees & Co., Parliamentary Agents) said that it was incorporated in 1881 and was supplying only within the Urban District of Ashby de la Zouch. The issued capital was £23,049, consisting of £16,129 of Ordinary Stock and £6,920 of Preference Stock. The capital expenditure of June 30, 1937, was £19,053, so that there was an excess of capital over expenditure of approximately £4,000. The Company would not have applied for the Special Order on its own initiative, but the terms of the Gas Undertakings Act required that it should do so. As a non-statutory Company its relations with the Urban District Council had always been good, and there had been no trouble with regard to the laying of mains. During all the years in which the Company had supplied gas there had been no suggestion so far as the Company was aware of purchase of the undertaking by the U.D.C.; only when the Company applied for its Special Order, as it was required to do, had the Council suggested the insertion of a purchase clause. It was proposed that the clause should provide that if the U.D.C. promoted a Bill for the purchase of the undertaking, the Company should not oppose it, except as to the details thereof, and that the Company should not claim enhanced value by reason of having obtained statutory powers.

The provisions of that suggested clause were somewhat wide, and there was no limit of time during which it should operate. The Company did not agree to the insertion of such a clause, and there was no precedent for it in a Special Order made under the provisions of the Gas Undertakings Act, and no precedent for its insertion by the Board of Trade under the Gas and Water Works (Clauses) Act, 1870, or the Gas Regulation Act of 1920. Parliament had inserted a purchase clause in two cases in the last century, and in one of those cases the ratepayers of the district concerned had objected to the Bill which it was proposed to promote to acquire the undertaking. On the other hand, in recent years many local authorities had sold their undertakings to companies.

In the objections of the Ashby de la Zouch Rural District Council it was stated that the application for the extension of the Ashby Company's area of supply to include parishes in the Ashby Rural District was unnecessary, inasmuch as no application for a supply had ever been made except in one parish. Particular objection was taken to the Company having powers to supply in part of the parish of Measham, on the ground that probably an adequate supply could be afforded there by the Measham Gas Company (a private company) or by the undertaking of the Coalville U.D.C. As to other parishes within the Ashby R.D.C. which it was proposed to include in the Ashby Company's limits, it was suggested that no supply would be given in those parishes because the price would be prohibitive. The R.D.C. had no wish to deprive the inhabitants of a supply of gas, provided the price was substantially less than was quoted in the Draft Order.

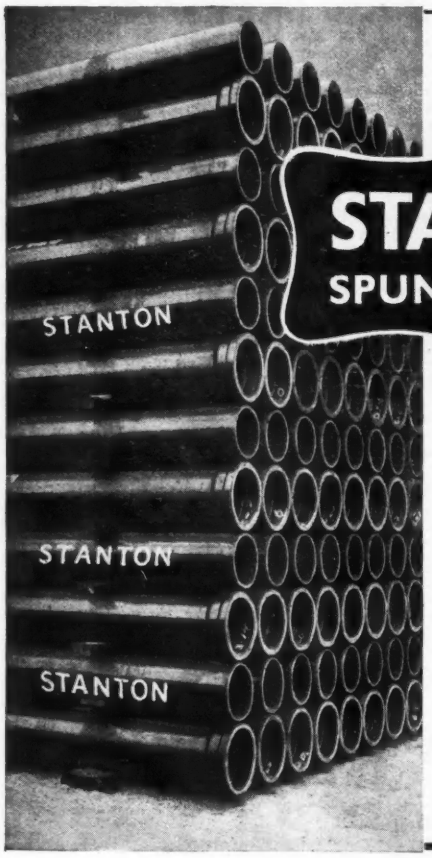
With regard to Measham, Mr. Lees said that in fact the Ashby Company had agreed with the Measham Company not to supply in Measham without the consent of the latter Company.

The R.D.C. objected to the differential charge proposed to be allowed in the extended limits as compared with the inner area, and stated the conviction that the price should be less in the outer than in the inner area. Mr. Lees referred to that statement as being remarkable, for the outer area was the more sparsely populated.

It might be that the Ashby U.D.C. had not appreciated the ramifications involved in its suggested purchase of the undertaking. The Company asked for the extension of its limits to include part of the Ashby Wolds Rural District and certain parishes in the Ashby de la Zouch Rural District, and the two latter authorities might object to the U.D.C. acquiring the undertaking.

In urging that it was unreasonable to insert the proposed purchase clause, Mr. Lees said that in the two cases mentioned in which a purchase clause had been inserted by Parliament, nearly 40 years ago, the operation of those clauses was limited to one year. But there was very grave objection even to a clause which would operate for only a year, for it would sterilize the operations of the undertaking for that period. Again, the suggestion that, in the event of sale to the U.D.C., the Company should not claim enhanced value by reason of having obtained statutory powers was unfair; having assumed the liabilities of statutory powers, the Company should benefit also; the stability of the Company must be improved as the result of the statutory powers, and it was only reasonable that the shareholders should claim a higher value for their shares. It would appear rather contradictory for the Board of Trade to give an undertaking statutory powers and to say, in the same breath, that it must be bought up as if it were non-statutory.

Apart from value, the Company submitted that the acquisition of the undertaking by the Local Authority would be a retrograde step. Amalgamations were being effected throughout the country, and in numerous cases local authority undertakings were being sold to companies. The U.D.C. was protected to the extent that the undertaking could not be sold without the Council's knowledge; but the Council could not be protected against the sale of shares. The Council had not made any



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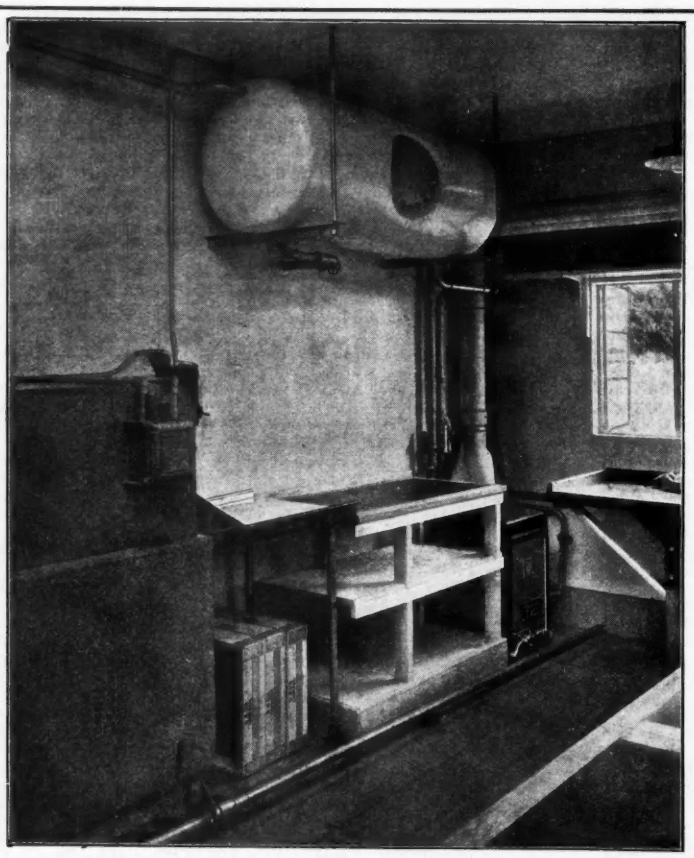

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definite proposals for purchase. There had been no suggestion of mismanagement of the undertaking, or of default.

Mr. *George Evetts* (Consulting Engineer, of Westminster) gave evidence, and said he had advised the Company. There had been a slight increase in the amount of gas manufactured during the last few years. The amount made for the year ended June, 1937, was 38 million cu.ft., of which 35½ millions was sold. A biscuit factory had consumed 15·1 millions, or 42½%, in that year. The prices charged were 4s. 2d. per 1,000 cu.ft. to ordinary consumers, there being discounts varying up to 20%; and 4s. 7d. to slot meter consumers (including the free provision of a cooker). There was a lower rate for industrial use, and the average receipts for gas were 3s. 11d. per 1,000 cu.ft. (ordinary, slot meter, and industrial consumers).

The value of the fixed capital assets was £19,053 (capital expenditure). The Company asked for an authorized share capital of £25,000 (which would give £1,951 in addition to the £23,049 already issued), and borrowing powers of 50% of the issued capital—*i.e.*, £12,500 maximum. There was no loan capital at present; so that the terms of the Order would provide unexpired capital and loan powers of £14,451.

The estimated capital expenditure during the next 10 years was £18,250, which could be met by the £14,451 unexpired capital powers and the existing amount of approximately £4,000 which had been already issued but not expended. If the added area of supply were fully developed during the next ten years, or if the biscuit factory increased its demand for gas, the capital expenditure of £18,250 would not be sufficient for that period. The capital expenditure so far worked out at about £526 per million cu.ft. sold; but future development would cost more.

The maximum price proposed under the terms of the Order was 1s. per therm; and the proposed differential for the new outer area was 3d. per therm. The area within a radius of 1½ miles of the works was defined as the inner area, and it embraced the Urban District, with trifling adjustments. So far there were no consumers outside the Urban District or outside the 1½ miles radius. In the area between the radii of 1½ miles and 3½ miles from the works there were 1,550 houses, and with the aid of a differential charge there was a distinct prospect of supplying the consumers there without injuring the consumers in the Urban District or without taking a subsidy from them to support the outer district. There would be no such prospect without the aid of the differential. His estimates were based on securing consumers in 80% of those 1,550 houses ultimately.

So far as he was aware, the U.D.C. was not bringing evidence to suggest that it could conduct the undertaking better than the Company, and he had no reason for thinking that it could; indeed, he suggested that the Council could not manage it so well as the existing Company, for the technique would be new to the U.D.C. and in the apprenticeship stage the gas consumer's interests would suffer. Further, assuming the U.D.C. bought the undertaking at a reasonable price, the combined toll of the interest and sinking fund payments would be greater than the amount of the dividends paid at present. On the other hand, the Gas Company's Directors had years of experience.

If the U.D.C. endeavoured to purchase the undertaking, he would advise the Company to sell the undertaking as a statutory concern and to secure the best price it could. Examination of the facts relating to the purchases of statutory and non-statutory undertakings showed that statutory undertakings secured an addition of anything from two to five years' purchase of their dividends or profits as compared with non-statutory undertakings.

A great deal of his time during the 35 years he had spent in consulting engineering work had been devoted to attempting to rationalize the industry, in the best sense of the word, whether by amalgamations, or bulk supplies, or coke-oven gas contracts; and one of the biggest obstacles had been municipal possession. When the Industry was gradually converting the municipal mind to the advantages of selling back to a company undertaking when circumstances were propitious from the point of view of the consumers, it seemed wrong to go the other way in this particular instance. Where purchase powers were claimed there was usually some suggestion that the Company concerned had been badly managed, and that the undertaking could be better managed by the municipality; but he could not see that the Ashby Company had been other than well managed, or that it would be better managed by the U.D.C.

Mr. L. M. Darlo (representing the U.D.C.) said he believed the objection of the U.D.C. arose because about a year ago there was a movement to sell the undertaking to a holding company. The Council felt that it would not be to the good of the consumers that the undertaking should be sold to a holding company, because he believed it had been proved that when a holding company took over a small undertaking, the consumers very seldom received the benefit of any surplus profits which should go back to them.

Mr. *Evetts* said that, as a Director of the Holding Company which had discussed the matter with the Directors of the Ashby Company, it was not for him to defend the policy of holding companies. But he pointed out that the Directors of the Ashby Company were not contemplating a sale of the undertaking, and, indeed, they could not do that. But the shareholders had the right to sell their shares, and the Board of Trade could not insert a provision in the Order or do anything else to prevent that. The Directors could not amalgamate the undertaking without the knowledge of the U.D.C. and of the Board of Trade.

Mr. Darlo said the fear was that as soon as the Order was made there would be another movement to sell to a holding company.

Mr. *Evetts* replied that holding companies, in purchasing gas undertakings, had given value for everything they had taken out of them.

Mr. Ronca asked whether the U.D.C. sought to promise that if the shares of the Company were acquired by a holding company the price of gas would be reduced, or whether Mr. Darlo was putting the Council's view that when a holding company secured the shares of an undertaking, prices never were reduced.

Mr. Darlo said he was putting the latter proposition.

Mr. *Evetts*, invited by Mr. Ronca to comment on that, said that until six or nine months ago the two groups in which he was interested had not in any case increased the price of gas, but in many cases had decreased it. But in certain cases during the last six to nine months prices had had to be increased, for there had been increases in the price of coal, there had been two wage increases in fifteen months, and the prices of all commodities had increased, some as much as 40% in three months.

Mr. Darlo said he presumed the negotiations with the holding company were discontinued because shareholders objected to the sale.

Mr. *Evetts* replied that the scheme in view was the ordinary scheme for the sale of the shares, and the shareholders rejected it. He did not know the reason for their objections, but the insertion of the proposed purchase clause in the present Order would not prevent that in any case.

Dealing with the statement that the Council wanted a safeguard against the price of gas being increased to the maximum price allowed, Mr. Evetts said the Company had been extremely moderate in regard to the maximum price, for it had left a margin of 5d. per 1,000 cu.ft. between the present price and the authorized maximum. No company would increase the price of gas merely because it had an authorized maximum; the price must be determined by economic factors, most of which were beyond the control of the gas companies. If a holding company were in the business to make money, the worst thing they could possibly do would be to increase the price of gas. In the early stages of the increase of prices of commodities a holding company would probably withhold an increase in the price of gas longer than would an ordinary company, in order to prevent people making a talking point that the holding company had increased the prices. Some small companies whose shares had been taken over by holding companies would have ceased operations within two or three years if they had not had the support of the bigger neighbours in the holding companies.

There was some further discussion as to whether the Urban District Council would consider withdrawing the proposal for the purchase clause in the Order. Mr. Darlo offered to ask his Council if it could modify the clause, but Mr. Lees pointed out to him that the Company objected to the clause in any shape or form.

Ultimately Mr. Darlo intimated that he would consult his colleagues on the Council with a view to re-considering the proposed clause, and the fact was stressed that the relations between the Council and the Company had always been quite happy.

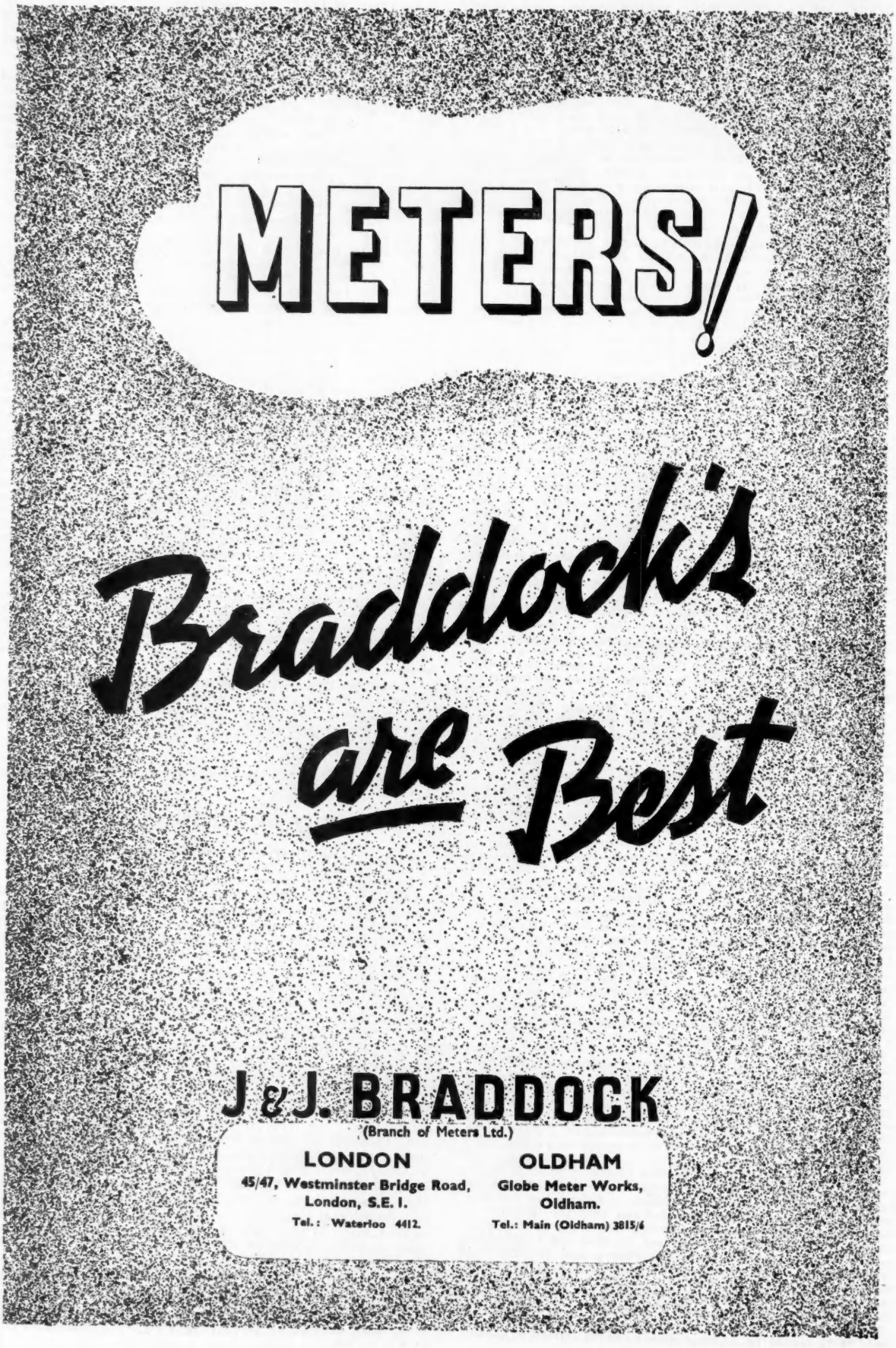
Toxicity of Industrial Solvents

Summaries of Published Work

In response to a request from the Home Office for a scientific investigation into the possibility of various volatile substances having injurious effects upon the health of workers using them under industrial conditions, the Medical Research Council, Industrial Health Research Board, appointed a special Committee to study the problem. A Report* has now been published comprising extracts from all the existing information that could be obtained as to the effects on animals and man of the various solvents used in industry. The main objective in the collection and publication of the data is the avoidance of poisoning from the use of such solvents and the indication of methods of prevention. As the Committee point out in an introduction to the Report, it is often difficult to determine, should illness occur in a worker or group of workers, whether or not this is due to the toxic action of chemical agents; and the difficulty is often increased by the slow development of symptoms which may occur after prolonged or intermittent exposure to low concentrations.

As producers and users of organic solvents the Gas Industry will find the Report, which is a most comprehensive document, of both interest and value. The vast amount of information the Report contains is presented in an excellent way. The extent of the problem is shown and the most suitable points of attack are indicated. The book runs to 382 pages and there is a carefully prepared index; it will be of very great help to investigators in this field of experiment.

* Industrial Health Research Board Report No. 80. Summaries of Published Work, compiled by Dr. Ethel Browning. H.M. Stationery Office, price 7s. 6d. net.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Gas Undertakings' Results

Churnet Valley.

The Directors of the Churnet Valley Gas Company present accounts for the year ended Sept. 30, 1937, which show a profit on revenue account of £936. To this has to be added the unappropriated balance from the previous year of £1,479, making £2,415. Against this has to be charged debenture and bank interest for the year, making together £391, leaving for disposal the sum of £2,023. This the Directors recommend shall be applied in the following manner, viz.: By paying a dividend for the year ended Sept. 30, 1937, at the rate of 2½% per annum (less tax) and writing off engineering charges to the extent of £250, which leaves to be carried forward to the current year the balance of £1,398.

Metropolitan Gas Company (Melbourne).

Speaking at the Annual General Meeting of the Metropolitan Gas Company of Melbourne, held at the offices of the Company on Aug. 16, the Chairman, Mr. P. C. Holmes Hunt, said: The coal carbonized amounted to 269,403 tons—an increase of 7,321 tons over the 1935-36 period. We also used 1,240,305 gallons of oil and 19,557 tons of coke in the production of gas. From sales of gas, revenue reached £1,180,789, an advance of £54,898 on the twelve months' figures to June 30, 1936. The quantity of gas sold reached a new high level, 4,344,666,000 cu.ft.—an increase of 216,988,000 cu.ft., or 5·25% over the previous period. Our previous peak year was in 1930, when 4,203,311,000 cu.ft. were sold. Our latest figures, therefore, are 3·36% above the 1930 peak, and 15·63% in advance of the 1932 low. Shareholders will be gratified at the continued progress being made. Returns from the sale of residual products totalled £191,804, as against £193,896 for the corresponding period 1935-1936, showing a decrease of £2,092 in the net revenue. The sales of coke and breeze have continued to show a satisfactory increase, and although competition in the fuel market is still very pronounced we have been able to dispose of most of the extra production over the past twelve months. It is satisfactory to note that crude tar sales for the year were ahead of the corresponding period 1936. Net profit for the year amounted to £217,231, and from that amount £40,000 has been transferred to reserve fund. In February last, your Directors declared an interim dividend of 6s. 6d. per share, and now recommend that a final dividend at the same rate be authorized. This is equal to 7·7% on capital subscribed by shareholders, and leaves an amount of £3,356 to be added to the carry forward, which will then total £77,171. Following record sales of appliances in the previous year, the past twelve months have been marked by intense sales activity and still further substantial increases. In 2,920 new residences completed, there were installed 2,883 gas stoves, 1,286 complete hot water services, and 917 bath heaters (totalling 2,203 water heaters), and 2,359 wash coppers. Sales of cookers show an increase of 11·2% over that of the previous year.

Trade Notes

C.O.L. Intermittent Vertical Chambers.

In last week's issue, under the heading of "C.O.L. Continuous Vertical Retorts," we referred to plant installed by Gas Chambers and Coke Ovens, Ltd., the plants having a total capacity of 30 million cu.ft. *per diem*. "These plants," the paragraph ran, "have been installed for such clients in the Gas Industry as the Gas Light and Coke Company, Portsmouth and Gosport Gas Company, Vancouver Gas Department, Metropolitan Gas Company of Melbourne, and the United Kingdom Gas Corporation." This statement refers to C.O.L. intermittent vertical chambers and not, as might seem to be implied by our heading, to continuous vertical retorts. The C.O.L. plants at Brough, Yorkshire, and Abergavenny, Monmouthshire, are, however, continuous vertical retorts.

Foster & Pullen Lighting Units.

Recent leaflets published by Messrs. Foster & Pullen, Ltd., deal with the firm's "Showray" fitting for interior lighting. This is available for red, white, blue, green, or amber effects, as desired, and is particularly suitable for display work. The unit comprises a three-light superheater cluster burner, with gas and air adjusters, by-pass, lever cock with chains and ring—the whole in chromium-plated finish. The reflector is of ribbed glass with mirror backing. Another unit for halls, passages, offices, shops, and workshops is called the "Interior" light, while for floodlighting their "Super" floodlamp is an interesting unit in a substantial tinned steel casing, with superheater burner and outside regulation and by-pass. The mirror reflector has an instantaneous setting with micrometer adjustment, the whole being provided with detachable feet. Useful accessories supplied by Foster & Pullen, Ltd., include their "Avil" anti-vibrators for the preservation of incandescent mantles where machinery or transport is liable to cause jolting or vibration. The firm also now supply a material specially manufactured for polishing lamp reflectors of stainless steel, aluminium, or chromium plate. Known as "Cleanol," this material is also suitable for cleaning the porcelain or vitreous enamel finish of gas cookers, washers, or boilers.

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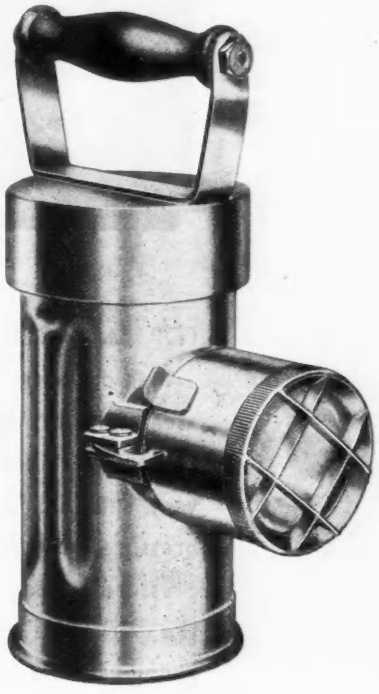
type NG7.



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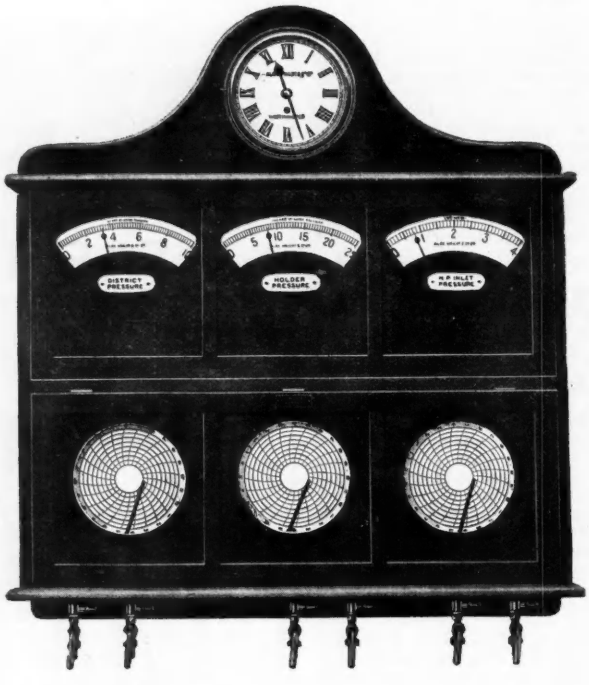
TRIALS GLADLY ARRANGED.

BATTERIES LIMITED
HUNT END WORKS REDDITCH



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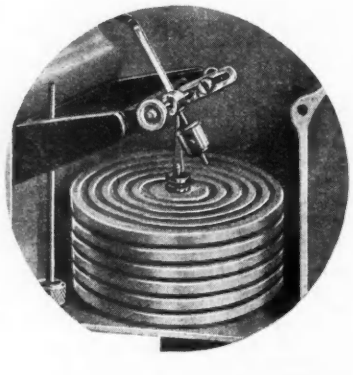

ALEXANDER WRIGHT & Co. LTD. WESTMINSTER S.W.I

Gas Markets and Manufactures

Stock Market Report

(For Stock and Share Lists, see later pages)

Last week the Stock Exchange passed through a memorable period. For apparently no reason at all sellers invaded markets during the first two days and prices were marked down indiscriminately. Jobbers refused to take up anything like the amount of stock offering and margins became very wide. By Wednesday, however, it was realized by some that the collapse in prices had no justification and, with plenty of bargains available, heavy buying began. The movement quickly spread and values improved to such an extent that at the close they were higher in many cases than a week ago. The recovery was still further strengthened on Friday by better news from Wall Street. Even British Funds at one time suffered with the rest and just failed to make up their losses, though several home rail ordinary and preference issues closed stronger. Leading industrials, oil, and mining shares received heavy support.

The Gas Market was very little affected either way by the vagaries experienced in other sections. On referring to the Stock and Share List it will be seen that one or two rather big falls occurred—*e.g.*, North Middlesex 5½ points and, at the Nottingham Exchange, Derby 5 points, but Newcastle units, to which reference was made in last week's Report, closed 3d. higher. Otherwise prices remained practically unchanged and there were no special features.

At the time of writing there are a few parcels of perpetual debenture stocks on offer, some of which are not always readily obtainable, giving a yield of 4% or over. Among these are the following, the yields being shown in brackets: Bishops Stortford 4% at 92 (£4 7s.); Bournemouth 4% at par; Commercial 5% at 120 (£4 3s. 3d.); Liverpool 4% at par; Newport (Mon.) 5% at 115 (£4 7s.); and South Suburban 5% at 119 (£4 4s.).

Current Sales of Gas Products

The London Market for Tar Products.

Nov. 29.

There is little of interest to record in the London Tar Products market, prices remaining as follows:

Pitch, 38s. per ton f.o.b.
Creosote, 6d. to 6¼d.
Refined tar, 3¾d.
Pure toluole, 2s. 4d. to 2s. 5d.; pure benzole, 1s. 9d.; 95/160 solvent naphtha, 1s. 7d. to 1s. 8d.; 90/160 pyridine, 11s. to 12s. —all per gallon naked at makers' works.

Tar Products in the Provinces.

Nov. 29.

The average prices of gas-works products during the week were: Gas-works tar, 24s. 3d. to 29s. 3d. Pitch—East Coast, 37s. to 38s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 37s. to 38s. 6d.* Toluole, naked, North, 1s. 8d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk, North, liquid and salty, 5d. to 5½d.; low gravity, 4⅜d. to 4½d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 4s. 1½d. to 4s. 3d. Naphthalene, £14 to £17. Salts, 80s. to 85s., bags included. Anthracene, "A" quality, 4¼d. to 4¾d. per minimum 40% purely nominal; "B" quality unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Nov.* 27.

The market remains rather inactive, but distillers continue to maintain quotations at a fairly steady level.

Crude gas-works tar.—Actual value is 37s. to 38s. per ton *ex* works in bulk.

Pitch is moving in small quantities at round 30s. to 32s. 6d. per ton f.o.b. Glasgow for export, and 30s. per ton *ex* works in bulk for home trade.

Refined tar is quietly steady at 3d. to 3¼d. per gallon free on rails for export, and 3½d. to 3¾d. per gallon *ex* works in buyers' packages for home trade.

Creosote oil is in reasonable demand with prices unchanged as follows: Specification oil, 5¼d. to 5¾d. per gallon; low gravity, 6¼d. to 6½d. per gallon; neutral oil, 5¼d. to 5½d. per gallon; all *ex* works in bulk.

Cresylic acid.—New business is still very scarce, but makers' prices are being held as under: Pale, 97/99%, 3s. 6d. to 3s. 8d. per gallon; dark, 97/99%, 3s. 3d. to 3s. 6d. per gallon; and pale, 99/100%, 4s. to 4s. 6d. per gallon; all *ex* works in buyers' packages.

Crude naphtha is quite readily disposed of at round 6d. to 6¼d. per gallon *ex* works in bulk, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 5d. to 1s. 6d. per gallon, and 90/190 heavy naphtha, 1s. to 1s. 1d. per gallon.

Motor benzole is changing hands at 1s. 4d. to 1s. 4½d. per gallon.

Pyridine.—Supplies being scarce, prices are nominal at 11s. to 12s. per gallon for 90/160 grade, and 12s. to 13s. per gallon for 90/140 grade.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	9½	to	0	10	per gallon at works
Motor ,,	1	3	,,	1	3½	,, ,, ,,
90% ,,	1	4	,,	1	4½	,, ,, ,,
Pure ,,	1	8	,,	1	8½	,, ,, ,,

Contracts Advertised To-Day

Benzole Recovery Plant.
Penrith U.D.C. Gas Department. [p. 762.]

Gasholder, Tank, and Concrete Foundations.
Birkenhead Corporation. [p. 762.]

Meters and Meter Repairs.
Batley Gas Department. [p. 762.]

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STOCK AND SHARE LIST

Official Quotations on the London Stock Exchange

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 26.	Rise or Fall on Week.	Transaction Lowest and Highest Prices During the Week.
1,767,439	Stk.	Sept. 6	8	8	Alliance & Dublin Ord. ...	161—166	−4	...
374,000	,,	June 21	4	4	Do. 4 p.c. Deb. ...	95—100	...	...
558,890	,,	Aug. 9	7	7	Barnet Ord. 7 p.c.	158—163	...	159—161
300,000	1	Oct. 4	1/9⅜	1/4⅛	Bombay, Ltd.	26/—28/-	...	26/6—27/-
179,915	Stk.	Aug. 9	9⅜	9⅜	Bournemouth sliding scale ...	200—205	...	...
590,407	,,	,,	7	7	Do. 7 p.c. max. ...	158—163	...	...
493,960	,,	,,	6	6	Do. 6 p.c. Pref. ...	133—138	...	135
50,000	,,	June 21	3	3	Do. 3 p.c. Deb. ...	79—84	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	98—103	...	100
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	115—122	...	...
357,900	,,	Aug. 9	7⅜	7⅜	Brighton, &c., 6 p.c. Con. ...	150—155	...	...
649,953	,,	,,	6¼	6¼	Do. 5 p.c. Con. ...	133—138	...	133—134
205,500	,,	,,	6	6	Do. 6 p.c. 'B' Pref.	127—133	...	130—132
855,000	,,	Sept. 20	8	7	British Ord.	145—150	...	145
100,000	,,	June 21	7	7	Do. 7 p.c. Pref.	140—145	...	...
350,000	,,	,,	5⅛	5⅛	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...	...
120,000	,,	June 7	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	96
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...	...
450,000	,,	,,	3⅛	3⅛	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1⅛—2⅛	...	...
100,000	10	6 Nov.'33	4⅛	4⅛	Do. 4½ p.c. Pref. ...	1⅛—3⅛	...	...
150,000	Stk.	June 21	4⅛	4⅛	Do. 4½ p.c. Deb. ...	79—84	...	...
626,860	,,	July 19	6	6	Cardiff Con. Ord.	125—130	...	...
237,860	,,	June 7	5	5	Do. 5 p.c. Red. Deb.	107—112	...	...
98,936	1	Oct. 4	2/-	2/-	Colombo Ord.	1⅛—1⅛	...	...
24,510	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref. ...	23/6—25/6	...	...
739,453	1	Oct. 4.	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	17/—19/-	...	...
296,144	1	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	22/—24/-	...	...
1,775,005	Stk.	Aug. 9	5	5	Commercial Ord.	82—87	...	...
620,000	,,	June 7	3	3	Do. 3 p.c. Deb. ...	74—79	...	...
286,344	,,	Aug. 23	5	5*	Do. 5 p.c. Deb. ...	113—118	...	...
807,560	,,	Aug. 9	7	7	Croydon sliding scale ...	140—145	...	...
644,590	,,	,,	5	5	Do. max. div.	108—113	...	111½
620,385	,,	June 21	5	5	Do. 5 p.c. Deb.... ...	113—118	...	...
239,000	,,	Aug. 9	5	5	East Hull Ord. 5 p.c.... ...	98—103	...	100
185,355	,,	Aug. 9	6	6	East Surrey Ord. 5.p.c. ...	120—125	...	...
176,211	,,	June 7	5	5	Do. 5 p.c. Deb. ...	113—118	...	...
250,000	1	Nov. 15	7	4	Gas Consolidation Ord. ...	19/6—21/6*	...	...
250,000	1	,,	4	4	Do. 4 p.c. Red Cum. Pref.	18/6—20/6*	...	...
19,255,284	Stk.	Aug. 9	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	25/—26/-a	...	25/—25/10½
2,600,000	,,	,,	3⅛	3⅛	Do. 3½ p.c. max.	83—86	...	84—86
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	99—102	...	100½—102½
2,993,000	,,	July 5	...	3¾	Do 3¾ p.c. Red. Pref.	101—103	...	101⅝—102¾
8,602,497	,,	May 24	3	3	Do. 3 p.c. Con. Deb. ...	79—82	+1	80—81⅛
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	112—115	...	114—114¾
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb....	111—114	...	112¼—113
700,000	,,	Sept. 6	3¼	3¼	Do. 3¼ p.c. Red. Deb....	94—99	...	98
270,466	,,	Aug. 23	6	6	Harrogate New Cons. ...	115—120	...	...
213,200	,,	Aug. 9	6	6	Hornsey Con. 3½ p.c. ...	118—123	...	...
5,600,000	,,	Nov. 1	12	8	Imperial Continental Cap. ...	137—142	−1	137—141
223,130	,,	July 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	89—94	...	92—93
285,242	,,	Aug. 9	8⅛	8⅛	Lea Bridge 5 p.c. Ord. ...	170—175	...	...
75,000	,,	May 24	†10	†10	Malta & Mediterranean ...	150—160	...	...
					Metropolitan (of Melbourne)			
392,000	—	Oct. 1	5⅛	5⅛	5½ p.c. Red. Deb.	100—103	...	...
231,978	Stk.	Aug. 23	5	5	M.S. Utility 'C' Cons. ...	101—106	...	104
968,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	96—101	...	96
360,075	,,	June 21	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...	...
675,000	,,	Nov. 15	†9	†6	Montevideo, Ltd.	88—93*	...	87½—89½
250,000	,,	Aug. 9	7½	7½	North Middlesex 6 p.c. Con.	147—152	−5½	148
396,160	,,	Aug. 9	5	5	Northampton 5 p.c. max. ...	110—115	...	...
300,000	,,	Oct. 18	†7	†9	Oriental, Ltd....	153—158	...	...
468,537	,,	June 7	8	8	Plymouth & Stonehouse 5 p.c.	157—162	...	...
621,667	,,	Aug. 9	8¼	8¼	Portsmouth & Gosport Cons.	164—169	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	104—109	...	...
73,350	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
441,275	1	Sept. 20	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	21/6—23/6	...	21/6—22/3
460,810	1	,,	-/10⅜	-/10⅜	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...	...
133,201	Stk.	Aug. 23	5	8⅛	Shrewsbury 5 p.c. Ord. ...	130—135	...	...
1,371,752	1	Sept. 6	1/2⅜	1/2⅜	South East'n Gas. Co.Ld. Ord.	23/—25/-	...	24/—24/6
871,636	1	,,	-/10⅝	-/10⅝	Do. 4½ p.c. Red. Cum. Pref.	20/—22/-	...	...
498,818	1	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/—20/	...	18/6—19/-
450,000	Stk.	Aug. 9	4	4	Do. 4 p.c. Deb.	99—102	...	...
150,000	,,	,,	3⅛	3⅛	Do. 3⅛ p.c. Red. Deb.' ...	96—99	...	...
6,709,895	,,	Aug. 9	6	5	South Met. Ord.	101—103	...	100¾—103½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf. ...	131—136	...	...
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf. ...	98—101	...	101
1,895,445	,,	June 21	3	3	Do. 3 p.c. Deb. ...	75—80	...	77½—78½
1,000,000	,,	July 5	5	5	Do. 5 p.c. Red. Deb....	110—113	...	...
1,543,795	,,	Aug. 9	6	6	South Suburban Ord. 5 p.c....	120—125	...	...
512,825	,,	,,	5	5	Do. 5 p.c. Pref....	110—115	...	111½
500,000	,,	,,	4	4	Do. 4 p.c. Pref....	95—100	...	...
250,000	,,	,,	...	§18/9	Do. 3½ p.c. Red. Pref.	98—101	...	...
888,587	,,	June 7	5	5	Do. 5 p.c. Deb....	115—120	...	116—117½
250,000	,,	,,	4	4	Do. 4 p.c. Deb....	98—101	...	...
200,000	,,	Sept. 20	...	3½	Do. 3½ p.c. Red. Deb.	94—99	...	...
427,859	1	Nov. 1	1/2⅜	9⅜	S. Western Gas & Water Ord.	18/6—20/6	...	18/6—19/1⅜
160,523	1	,,	-/10⅛	-/10⅛	Do. 4½ p.c. Red. Cum. Pf.	19/6—21/6	...	...
110,000	Stk.	June 21	4	4	Do. 4 p.c. Red. Deb. ...	97—102	...	...
750,541	,,	Aug. 9	5⅛	5	Southampton Ord. 5 p.c. ...	111—116	...	...
148,836	,,	June 7	4	4	Do. 4 p.c. Deb.	97—102	...	...
350,000	,,	Aug. 23	5⅛	5⅛	Swansea 5½ p.c. Red. Pref. ...	110—115	...	...
94,000	,,	June 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
1,076,490	,,	Aug. 9	6⅝	6⅝	Tottenham and District Ord.	133—138	...	...
409,835	,,	,,	5⅛	5⅛	Do. 5½ p.c. Pref....	121—126	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
371,850	,,	June 7	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
888,629	1	Oct. 4	6	4	U. Kingdom Gas Cor. Ord.	20/—22/-	...	20/3
937,743	1	Nov. 15	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	20/—22/-*	...	19/9—20/6
745,263	1	June 7	4½	4½	Do. 4½ p.c.2nd Non-Cum.Pf	17/—19/-	...	...
1,000,000	Stk.	Sept. 20	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...	97⅞
373,939	,,	Aug. 9	7	7	Uxbridge, &c., 5 p.c. ...	138—143	...	...
133,010	,,	,,	5	5	Do. 5 p.c. Pref. ...	109—114	...	...
1,371,138	,,	Aug. 9	7	7	Wandsworth Consolidated ...	140—145	...	142—143
2,525,768	,,	,,	4	4	Do. 4 p.c. Pref. ...	99—102	...	99½—100⅛
1,343,964	,,	June 7	5	5	Do. 5 p.c. Deb. ...	115—120	...	...
383,745	,,	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
558,342	,,	Aug. 9	7	7	Watford and St. Albans Ord.	138—143	...	144
200,000	,,	,,	5	5	Do. 5 p.c. Pref. ...	109—114	...	...
200,000	,,	,,	5⅛	5⅛	Do. 5½ p.c. Pref. ...	121—126	...	...
200,000	,,	June 7	4	4	Do. 4 p.c. Red. Deb.	97—102	...	...
100,000	,,	,,	3½	3½	Do. 3½ p.c. Red.Deb.	95—100	...	...

a.—The quotation is per £1 of Stock. * Ex div. † Paid free of income-tax. ‡ For year. § Actual.

Stock and Share List continued overleaf.

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BRISTOL EXCHANGE.								
347,756	Stk.	July 19	6	5	Bath Cons.	120—122	...	...
1,667,250	,,	July 19	5	5	Bristol, 5 p.c. max.	115—117	−½	...
120,420	,,	June 7	4	4	Do. 1st 4 p.c. Deb. ...	100½—102½	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100½—102⅝	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	120—123	...	...
274,000	,,	July 19	5	5	Newport (Mon.) 5 p.c.max. ...	101—106	...	...
13,200	12	Sept. 6	8	7	Pontyp'l Gas & W. 10 p.c. 'A'	13—14	...	...
13,600	10	,,	6	5	Do. 7 p.c. 'B'	11⅞—12⅜	...	...
40,000	10	,,	6	5	Do. 7 p.c. 'C'	11¼—12⅛	...	...
140,778	Stk.	Aug. 9	5	5	Weston-super-Mare Cons. ...	110—112	...	...
64,338	,,	June 21	4	4	Do. 4 p.c. Deb.	96—98	...	...
33,340	,,	,,	7½	7½	Do. 7½ p.c. Deb.	157—160	...	...
LIVERPOOL EXCHANGE.								
157,150	Stk.	Aug. 9	6½	5	Chester 5 p.c. Ord.	104—109	...	...
92,500	,,	June 21	4	4	Do. 4 p.c. Pref.	97—101	...	
36,430	,,	,,	3½	3½	Do. 3½ p.c. Deb.... ...	89—92	...	...
41,890	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	98—102	...	...
2,167,410	,,	Aug. 23	6	6	Liverpool 5 p.c. Ord. ...	125½—127½	...	...
245,500	,,	June 21	5	5	Do. 5 p.c. Red. Pref. ...	99—104	...	...
306,083	,,	July 1	4	4	Do. 4 p.c. Deb. ...	102—104	...	...
106,280	,,	Aug. 9	10	10	Preston 'A' 10 p.c.	206—216	...	...
188,219	,,	,,	7	7	Do. 'B' 7 p.c.	147—157	...	...
NEWCASTLE EXCHANGE.								
122,577	Stk.	Aug. 9	8	8	Blyth 5 p.c. Ord.	165—166	...	...
732,000	,,	Aug. 9	5	5	Hartlepool G. & W. Cn. & New	117—119	...	...
2,061,315	,,	Aug. 9	5½	5	Newcastle & Gateshead Con.	23/—23/6*a*	+/-3	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	98—100	...	...
776,706	,,	June 21	3½	3½	Do. 3½ p.c. Deb. ...	90½—91½	...	...
277,285	,,	Nov. 1	5	5	Do. 5 p.c. Deb. '43...	103—105	...	...
332,351	,,	Aug. 23	6	6	Sunderland 6 p.c. max. ...	139—141	...	...
NOTTINGHAM EXCHANGE.								
542,270	Stk.	Aug. 9	9	6	Derby Con.	135—145	−5	...
55,000	,,	June 7	4	4	Do. 4 p.c. Deb.	100—105	...	...
20,000	10	June 7	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...	...
80,000	Stk.	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...	...
SHEFFIELD EXCHANGE.								
10,000	Stk.	Sept. 20	10	10	Great Grimsby 'A' Ord. ...	210—220	...	...
6,500	,,	,,	10	10	Do. 'B' Ord. ...	210—220	...	...
79,000	,,	,,	10	10	Do. 'C' Ord. ...	205—210	...	...
1,806,339	,,	Aug. 23	6	6½	Sheffield Cons.	144—148	...	...
95,000	,,	July 5	4	4	Do. 4 p.c. Deb.	100—103	...	...
Supplementary List of Stocks and Shares not Officially Quoted								
202,152	Stk.	Sept. 6	25/-*b*	5	Ascot Ord.	100—105	...	...
128,182	,,	July 5	5	5	Do. 5 p.c. Pref.	108—113	...	...
573,156	1	Nov. 15	5	5	Assd. Gas and Water Ord. ...	19/—21/-*	...	...
167,506	1	,,	...	-/4*c*	Do. 4 p.c. Red. Cum. Pref.	19/—20/-*	...	20/-
253,118	1	,,	...	4	Do. 4 p.c. Irred Pref. ...	18/—20/-*	...	...
500,000	1	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/—21/-*	...	...
500,000	Stk.	Sept. 6	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
31,035	1	Aug. 23	...	-/4½	Associated Utilities 4 p.c. Pref.	16/6—18/6	...	...
100,000	Stk.	...	...	...	Do. 3½ p.c. Red. Deb.	95—100	...	...
17,000	,,	Aug. 23	8	8	Bognor Orig. Ord. 'A' ...	160—170	...	...
62,210	,,	,,	8	8	Do. New Addl. 'A' ...	160—170	...	...
87,160	,,	,,	7	7	Do. New 7 p.c. max. ...	141—146	...	...
37,440	,,	Aug. 9	10	10	Cam. Univ. & Town 10 p.c.max.	193—203	...	...
125,970	,,	,,	7	7	Do. 7 p.c. max.	135—140	...	...
39,025	,,	,,	5	5	Do. 5 p.c. max.	98—103	...	...
65,000	,,	Aug. 9	8½	7½	Eastbourne 'A' 5 p.c. ...	158—163	...	...
198,000	,,	,,	7	6	Do. 'B' 3½ p.c.	128—133	...	130—131½
112,312	,,	,,	5	5	Do. 5 p.c. Pref.	108—113	...	110—111
130,000	,,	June 21	5	5	Do. 5 p.c. Deb.	115—120	...	...
24,000	30	Aug. 23	8½	8½	Great Yarmouth 8½ p.c. max.	44—49	...	...
59,400	30	,,	7½	7½	Do. 7½ p.c. max.	34—39	...	...
51,160	Stk.	June 7	5½	5½	Do. 5½ p.c. Deb.	120—125	...	...
152,600	,,	Sept. 6	9	8	Guildford Cons.	170—175	...	...
54,055	,,	,,	5	5	Do. 5 p.c. Pref.	110—115	...	...
68,250	,,	June 7	5	5	Do. 5 p.c. Deb.	113—118	...	...
156,600	,,	Aug. 23	7½	7½	Hampton Court Cons. ...	158—163	...	...
73,620	,,	Sept. 6	8½	8½	Luton Cons. 'A'	163—168	...	...
107,960	10	Sept. 20	5½	4	Mid Kent Ord.	8¾—9¾	...	...
230,940	Stk.	Aug. 9	10	10	Oxford & District Ord. ...	205—210	...	...
47,112	,,	,,	5	5	Do. 5 p.c. Pref.	108—113	...	...
50,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	110—115	...	...
126,193	,,	Nov. 15	7½	7½	Peterborough Ord.	158—163*	...	...
64,990	,,	Sept. 6	7½	6¾	Redditch Ord.	125—135	...	...
166,850	,,	Aug. 9	8	8	Romford Ord.	155—165	...	...
60,000	,,	,,	4	4	Do. 4 p.c. Pref.	97—100	...	...
44,000	,,	Sept. 20	5	5	Do. 5 p.c. Deb.	113—118	...	...
25,570	,,	Aug. 9	5½	5½	Rugby 5½ p.c. Pref.	125—130	...	...
25,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	106—111	...	...
42,750	,,	June 7	5½	5½	Do. 5½ p.c. Deb.	122—127	...	...
10,950	,,	Aug. 23	8	8	Ryde Ord.	158—163	...	...
270,086	,,	Sept. 6	7	7	Slough Ord.	135—140	...	...
21,000	,,	June 21	5	5	Do. 5 p.c. Deb.... ...	112—117	...	...
28,872	1	Nov. 1	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	19/—21/-	...	...
28,866	1	Sept. 6	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	18/6—20/6	...	...
137,730	Stk.	Aug. 9	7	7	Southgate & Dist. 7 p.c. max.	140—145	...	...
62,500	,,	,,	5	5	Do. 5 p.c. Pref.	110—115	...	...
117,228	,,	Aug. 23	5	5	Swindon Cons.	106—111	...	...
60,425	,,	June 7	5	5	Do. 5 p.c. Deb.	110—115	...	...
64,380	,,	June 7	5	5	Torquay and Paignton 5 p.c. Pf	110—115	...	...
500,000	1	Nov. 15	...	- 1·15*c*	United Kingdom Gas Corpn. 4 p.c. 1st Red. Cum. Pref.	19/—21/-*	...	...
33,858	1	,,	...	-/2·70*c*	Do. 4½ p.c. 1st. Cum Pref.	20/—22/-*	...	...
130,000	Stk.	Aug. 9	8	5	Wakefield Ord.	120—125	...	...
81,650	,,	,,	5	5	Do. 5 p.c. max.	103—108	...	...
82,000	,,	Aug.	6	6	Weymouth Ord.	103—108	...	...
98,384	,,	Aug. 9	6	6	Wolverhampton 6 p.c. Pref....	120—125	...	...
160,000	,,	June 21	5½	5½	Do. 5½ p.c. Rd. Db	108—113	...	...
90,000	,,	June 21	5	5	York 5 p.c. Red. Deb. ...	105—110	...	...
133,640	,,	July 19	6¼	6¼	Yorkstown (Cam.) 5 p.c Cons.	128—133	...	...
120,000	,,	,,	5	5	Do. 5 p.c. Pref.	108—113	...	...
35,000	,,	June 7	5½	5½	Do. 5½ p.c. Deb.	123—128	...	...

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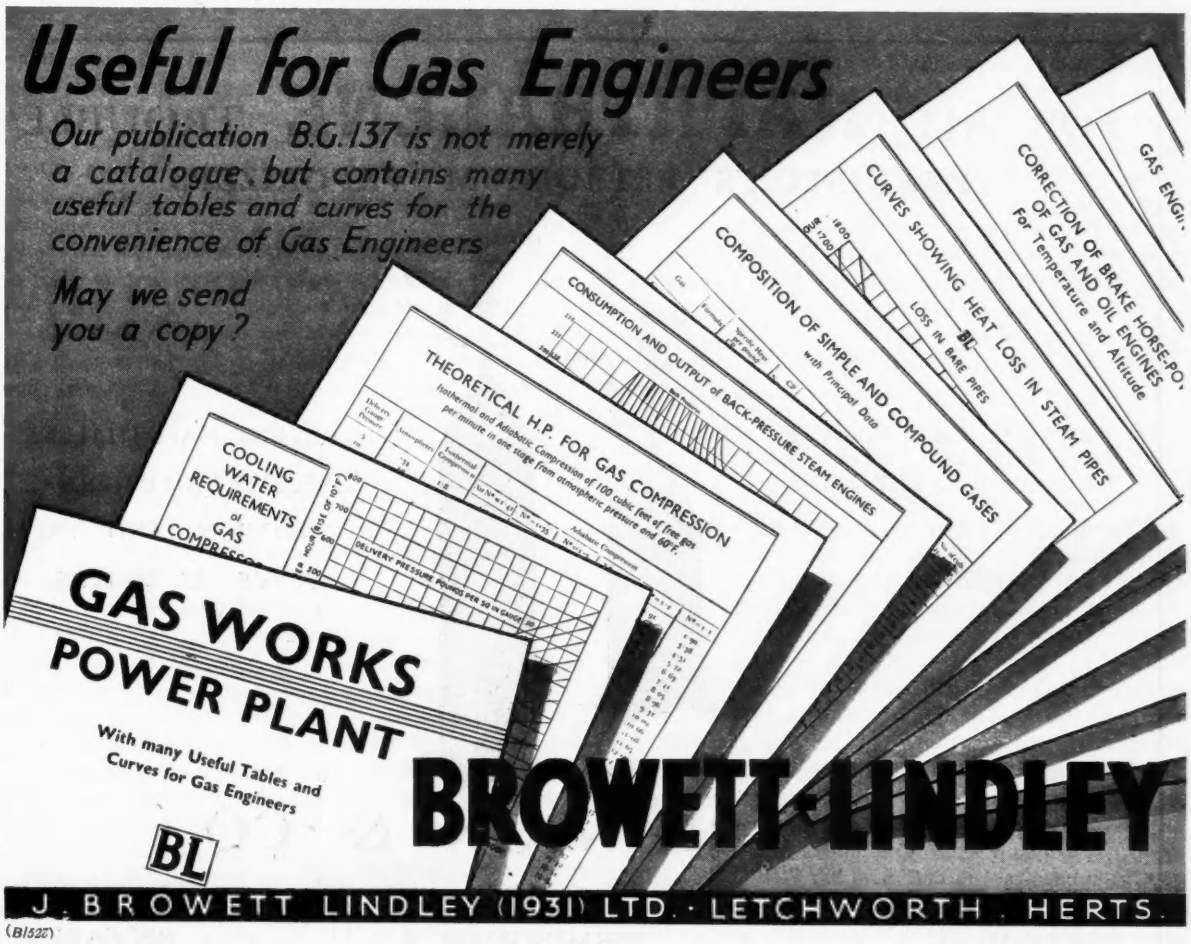
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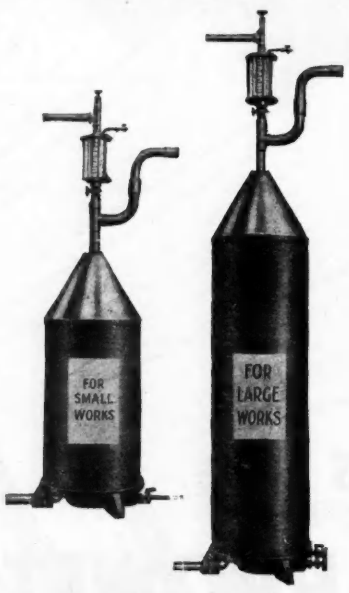

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